HARLEQUIN® PLUS
SERVER RIP

Harlequin ColorPro™ User's Guide

Version 9.0

June 2011

the smarter alternative™
GLOBAL GRAPHICS®

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Harlequin ColorPro

Harlequin PLUS Server RIP v9.0

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Chapter 1–Introduction

1.1 What is Harlequin ColorPro™?

Welcome to ColorPro™—a full feature color solution for the Harlequin® RIP.

ColorPro together with SetGoldPro™ profile making software is Global Graphics' color science solution for ensuring color quality and accuracy for proofing and emulation. ColorPro provides the largest realizable color gamuts for the final print market and allows greater accuracy than would be possible using standard profiles.

Harlequin ColorPro embraces open systems, industry standards and device-independent color science, and is able to make full use of them. If you have ICC profiles with which you already achieve good results, you can use these profiles with ColorPro. You should however be aware that ColorPro contains color science that is optimized for the Harlequin RIP and is easily utilized with the introduction of SetGoldPro.

Note: The ICC profile format is specified by the International Color Consortium (http://www.color.org/), established in 1993, has the charter for creating and promoting the standardization of open, vendor-neutral, cross-platform color management systems.

One of the unique features of ColorPro is that you can mix and match SetGoldPro profiles and ICC compliant profiles within ColorPro setups, if that is what produces the best results for you.

ColorPro solves real-world color reproduction problems for the graphic arts market and is available as a password protected option in the Harlequin RIP.

Harlequin ColorPro is a direct replacement for the previous Harlequin RIP color management systems including HIPP, HCMS, and HFCS. Your existing HIPP password will activate Harlequin ColorPro.

It is possible to obtain some of the benefits of color management by using a ProofReady output plugin with the Harlequin RIP. ProofReady plugins are ready for use, but you can expand their capabilities by using a ColorPro option. See "ProofReady plugins" on page 6 for details.

Global Graphics Software (GGS) supplies a range of device profiles for commonly used color standards. These profiles are available for immediate use and incorporate linearization data for output devices.

Some graphics applications include color management information in images or jobs that they produce; Adobe Photoshop is one such application. When processing jobs from these applications, you can choose to use either the color management information contained in the jobs or the more detailed controls provided by a ColorPro option. Jobs can contain color management information in several forms: as an embedded ICC profile; a color space array (CSA); or as specified by `UseCIEColor`. See Appendix C, "Jobs Containing Color Management Data", for details.

1.2 Getting started with ColorPro

This section provides a map of this document so you can quickly get your system installed, configured and working. This document provides the following information:

- Chapter 1, "Introduction" (this chapter) provides you with information about what ColorPro is and how it is different to previous Harlequin RIP color software. In addition, it provides information on ProofReady plugins, the available rendering intents and emulation.
- Chapter 2, "ColorPro workflows", provides several examples of workflows and how you should configure them in ColorPro. You may find a workflow example in this chapter that you can use as a starting point for configuring your own workflow.
- Chapter 3, "Using Harlequin ColorPro", shows you how to activate ColorPro and provides full details on all the options available including: Installing ICC profiles, configuring a color setup and how to use that setup with your page setup.
- The various appendices provide extra related information.

1.3 Harlequin ColorPro features

Harlequin ColorPro is a complete and accurate color reproduction solution. It is a device-independent, cross-platform color management system developed to control color in today's digital printing and publishing environments. ColorPro manages all aspects of color print reproduction and is fully compatible with accepted industry standards.

ColorPro offers a technology-independent solution. Unlike most systems, which force you to compensate for color before you know how a job will be printed, ColorPro works without regard to the input and output devices used. In other words, you do not need to specify which devices will be used at the time the PostScript job is created. At run-time, ColorPro applies the proper transformations.

ColorPro allows you to specify different gamut-mapping algorithms in the reproduction of a page. For example, you can simultaneously specify *Absolute colorimetric* to reproduce some elements of the page and yet specify *Perceptual* to reproduce the photographs. The end result is that, on a single page, the color for photographs is calculated without affecting other elements on the page.

Harlequin ColorPro allows processing of colors in page data using SetGoldPro profiles or ICC profiles produced by OEMs, third parties, or end-users using third party characterization and profiling tools. Profiles specify a translation between two color spaces. Each profile is prepared for a specific set of imaging conditions. One device may have more than one profile. The profiles may correspond to running the device with different combinations of resolutions, inks, and paper.

New profiles can be easily added to ColorPro, and previously installed profiles can be selected without the need to reinstall each time a profile is used. An option to install and uninstall ICC profiles is provided.

In addition, ColorPro allows the use of profiles prepared in the Harlequin RIP format. Global Graphics supplies a number of profiles for commonly used systems. See Appendix E, "Supplied Profiles", for details.

1.4 What's new in Harlequin ColorPro?

ColorPro offers many advantages over previous color solutions provided with the Harlequin RIP.

From Harlequin PLUS Server RIP v9.0.0 support for Pantone PLUS colors is added.

From the Harlequin PLUS Server RIP v8.0r0 the **Use black point compensation** option is available. See Table 3.8 on page 37 for more information.

Also, the **Color Adjustments** options (`Fatser`, `Better` and `Accurate`) in the **Output Control** section have been improved. See Table 3.10 page 39 for more information.

1.4.1 Previous changes to ColorPro

The following features have been added or changed in previous versions of ColorPro:

Use late color management
: See Table 3.4 on page 31 for more information.

Emulation
: Allows your printer to produce proofs as if from your press.

Gray Profiles
: For scanned images, line art, text, and graphics.

N-color profiles
: Allowing any number of colors.

All the options within ColorPro are placed for convenience on a single Color Setup dialog for easy configuration. The options below have been moved to the Color Setup dialog.

Honor Color Management (PDF and PS)
: These options were previously in the Page Setup > PDF Options dialog and Page Setup Options > Extras dialog. The option is now called Override color management in job.

Fill background with paper color of job
: This option was on the Color Setup dialog and is now labeled Simulate paper color of job.

Color Options dialog
: These options have been moved to the Color Setup dialog.

With the color management solution previously offered with the Harlequin RIP, you were not able to do any emulation if you only had HIPP (Harlequin ICC Profile Processor) rather than HFCS (Harlequin Full Color System). This was because emulation used the CRD generator plugin, which was part of HFCS. With the Harlequin RIP Eclipse Release™ (and later) the CRD generator plugin is supplied as part of ColorPro and you have the choice as to whether you use it or not.

Note to OEM:
: If you do not supply the CRD generator plugin, you should remove all references to it.

With ColorPro you are able to create your own color rendering dictionaries (CRDs) and you are also able to emulate printing presses whose profiles do not have external CRDs—but only if you use the CRD generator plugin.

If you choose to emulate a printing press whose profile does have external CRDs you are offered a choice of ICC rendering intents, for example, `ICC perceptual`, `ICC colorimetric` and `ICC saturation`.

With ColorPro you are able to create color setups with or without color management. You can save the setups and associated them with different page setups within the Harlequin RIP.

1.5 Color and calibration

To ensure high color accuracy, make sure you calibrate your output device. See the chapter on "Calibration" in the *Harlequin RIP OEM Manual*.

1.6 Color mapping styles used in ColorPro

Various color mapping strategies are available with ColorPro. The standard strategies are:

- Default Absolute Colorimetric
- Default Relative Colorimetric

- Default Perceptual
- Default Saturation

These rendering intents use the values from an installed ICC profile together with settings from the Color Setup dialog box to generate a CRD at run time.

The information in this section also applies to the rendering intents that appear when ICC profiles are selected and when using the `->Default` option. For example:

- ->ICC colorimetric
- ->ICC perceptual
- ->ICC saturation

The `->Default` rendering intent is only available, and is the recommended selection, when using a ProofReady plugin and when a ProofReady media type is selected in the **Output Profile** menu. This rendering intent appears when the Profile selected was created using Global Graphics tools, and uses a CRD generated with settings considered to be optimal for the given printer and media configuration.

The `->ICC` rendering intents use CRD's installed in the RIP, and appear when an ICC profile has been installed and selected as either an **Output Profile**, (when emulation is not selected), or as an **Emulation Profile**.

Harlequin ColorPro can use these strategies from both ICC and Harlequin profiles. You are also able to modify these strategies and save them as new, named, strategies for later use.

The difference between the Harlequin derived and ICC rendering intents is that you are able to customize the Harlequin rendering intents using the Rendering Intent Manager see "Custom rendering intents" on page 25 for more information.

The names, Absolute colorimetric, Relative colorimetric, Perceptual and Saturation are the conventional terms for these color mapping strategies (rendering intents), and the Harlequin RIP uses these names for rendering intents derived from Harlequin profiles.

The names that appear for rendering intents derived from ICC profiles are slightly different—there is only one colorimetric intent—but all the same styles are available to the Harlequin RIP, provided that an ICC profile contains them. ICC and Harlequin rendering intents are not same but they do produce similar results.

The different naming scheme makes it easier for the best rendering intent to be selected by ColorPro so that it best suits the other choices you have made when creating a color setup.

Section 1.6.1 through Section 1.6.4 fully describe these options.

Appendix G, "Printing Color", has further details on absolute colorimetric mapping and perceptual mapping.

1.6.1 Absolute colorimetric

Any color the device can reproduce (with the intended setup and viewing conditions) is reproduced exactly. Colors outside the device gamut are mapped onto a "nearby" point in the gamut. There are various ways in which a color might be out of gamut. For example, it could be too saturated, lighter than the paper color, or darker than the darkest imageable patch.

Colorimetric reproduction is appropriate where an exact color match is required. For example, you may choose a colorimetric strategy when you are reproducing a logo in corporate colors.

Note: Absolute and relative colorimetric styles are closely related. For simplicity, ColorPro displays just the single name *ICC colorimetric* but internally it is able to use either style where it is appropriate.

1.6.2 Relative colorimetric

This style aims to reproduce colors exactly, except that the luminance (how light or dark a color is) is scaled so that the darkest possible color is mapped to the darkest imageable color, and the lightest possible color to the paper white. This style may change the hue (degree of redness, blueness, and so on) of any color, and is almost certain to affect the luminance of most colors.

Some scanners and applications produce data that has been adjusted so that the lightest and darkest point are encoded as maximum and minimum lightness. For interpreting this kind of image, the relative colorimetric style is appropriate.

1.6.3 Perceptual

This style maps the entire device-independent color space onto the gamut of the printer by compressing the range of in-gamut colors to make room for out-of-gamut colors. It is appropriate for rendering photographs and similar reproductions of natural scenes.

Note: This strategy was named *Photorealistic* in early Harlequin RIP color management systems.

1.6.4 Saturation

This style specifies that the saturation of the colors in the image is preserved, perhaps at the expense of accuracy in hue and lightness.

Note: This strategy was named *Business Graphics* in early Harlequin RIP color management systems.

1.6.5 Paper simulation

ColorPro allows you to reproduce the paper color of the input job in the output from the Harlequin RIP. This option is an important feature because, for example, some proofing stocks are very blue and contain optical brighteners which are not typical of papers that are run through presses (at least presses running inks). Thus paper simulation can help in proofing.

Paper simulation is controlled by the Simulate paper color of job check box in the Input Document Controls section of the New Color Setup dialog box. ColorPro processes other colors on the page to match the chosen background, so this setting implies "absolute" and "relative" modes. This could be a problem if the chosen rendering intent made a conflicting choice of absolute or relative rendering.

If the Simulate paper color of job check box is selected when using the `->ICC colorimetric` intent option, the color is *absolute*. When the check box is not selected the color is *relative*. This means that there cannot be a conflict, but allows full access to the rendering intents.

To clarify, if the Simulate paper color of job check box is selected when using the ICC colorimetric intent option, it changes the `->ICC colorimetric` option to *absolute* and the background color of the paper would appear on the proof. That is, if the background color of the paper is yellow, the proof would appear more yellow.

If the Simulate paper color of job check box is not checked, the `->ICC colorimetric` option becomes *relative* and the background color of the paper would not appear on the proof.

If the selected ICC intent is *perceptual*, *saturation* or one of the Harlequin derived intents, the RIP attempts to simulate the background.

Note: It is possible for a conflict to arise for the Harlequin derived rendering intents, because the Simulate paper color of job option only sorts things out for ICC rendering intents.

1.6.6 Rendering intent selection for emulation

In the ColorPro dialog there is no option for selecting a proofer rendering intent when an emulation profile is selected. When a profile is selected from the Output Emulation menu, the rendering intents selected in the Output Rendering Intents section apply to this profile. (It is not possible to select a rendering intent for the profile selected in the Output profile option.)

The Harlequin RIP automatically selects a rendering intent for the output profile in the following way:

1. If the Output Profile has any ICC output profiles associated with it, the RIP uses a Colorimetric profile if one exists.
2. If there is not a colorimetric profile, the RIP attempts to use a Relative colorimetric profile.
3. If a Relative colorimetric profile does not exist, the RIP uses the first profile it finds in the list of output profiles associated with the ICC profile.
4. If the Output profile has no associated ICC output profiles, the RIP generates a CRD with the CRD generator plugin. In this case the rendering intent used is Absolute colorimetric.

For information on how to choose these options see Table 3.8, page 37.

1.6.7 ICC auto-switching

Generally, rendering intents are manually assigned using the various options available within ColorPro. However, if you select an ICC output profile, ICC auto-switching becomes an available option in the Output Rendering Intents.

ICC auto-switching intelligently assigns different rendering intents based on the image types within a file.

- CMYK images are set to ICC colorimetric.
- RGB images are set to ICC perceptual.

1.7 ProofReady plugins

Each ProofReady plugin is supplied ready to use with preconfigured color management for several types of media. ProofReady plugins are generally used for inkjet printers used in the proofing and display markets.

With a ProofReady plugin, the way that you choose color management is simpler than the ColorPro options described in this manual, because the setups are ready to use. The special color setups appear in the ProofReady menu in the Output Device section of the Page Setup dialog box, each named for a particular combination of media and resolution. Choosing one of the entries from the ProofReady menu, gives you a default color setup that produces good results for most jobs.

When an option is selected from the ProofReady menu, the options in the Separations, Screening and Color section of the Page Setup dialog are enabled. This allows you to create and edit ProofReady color setups or separation styles. However, non-compatible separation styles and color setups cannot be selected or created.

Tis editing allows you to expand the capabilities of a ProofReady plugin with a ColorPro option, by creating and using custom color setups built upon the same profiles used to create the default color setups.

For more details of ProofReady plugins, see the user guide for the relevant ProofReady plugin.

The Harlequin RIP is able to perform calibration with ProofReady plugins. For more information see "Calibration and output profiles" on page 21.

Chapter 2–ColorPro workflows

2.1 Introduction

This section describes some useful workflows and how to configure them using the Harlequin RIP and ColorPro. These workflows are intended as examples to demonstrate practical solutions to common workflow configurations. The workflows are shown first with the most straightforward and becoming increasingly more complex. It is hoped that you find a workflow that closely matches your system requirements and, with a few minor adjustments, quickly get your system up and running.

There are several dialog boxes shown in this section with various options selected. Explanations are given where useful but full descriptions of every option are not given. For full descriptions of all the available options in the dialogs, see "Using Harlequin ColorPro" on page 16.

In this section the following workflows are described:

- CMYK ProofReady proofing, see "CMYK ProofReady proofing" on page 7.
- CMYK analog matching, see "CMYK—analog matching" on page 8.
- CMYK press proofing, see "CMYK—press proofing" on page 9.
- RGB Profiling—ICC model, see "RGB Proofing—ICC model" on page 10.
- RGB Proofing—SetGoldPro and Harlequin Pro models, see "RGB Proofing—SetGoldPro and Harlequin ColorPro models" on page 12.
- Multiple color space proofing, see "Multiple color space proofing" on page 13.
- For a discussion on emulation workflows, see "Emulation workflow details" on page 15.

2.1.1 CMYK ProofReady proofing

Traditional workflows typically use digital files from page layout applications, such as QuarkXPress® or InDesign™, which are rasterized and color managed before being sent to an output device. Generally, all the color page elements are prepared (converted to CMYK) for a known printing press using a defined ink and paper combination. For digital proofing, the Harlequin RIP provides many device plugins and more recently ProofReady plugins which are used with inkjet printers. If you are new to the Harlequin RIP and digital proofing, the quickest way to get started is to make use of a ProofReady "plug and print" pre-configured plugin. Because ProofReady plugins come pre-configured for use with your printer and provide a range of paper types, you can quickly and easily produce color accurate proofs.

Shown below is an example of a ProofReady plugin selected in the Harlequin RIP Page Setup dialog.

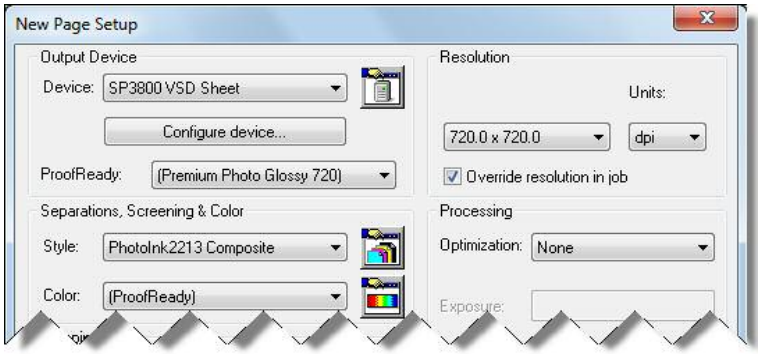

Figure 2.1 ProofReady plugin selected in RIP setup

This Page setup dialog box shows a ProofReady plugin pre-configured for use with an Epson Stylus Pro 3800 device using glossy photo paper and with a resolution of 720 dpi. You must have ColorPro enabled to use the profiles, but you do not need to do any further configuration. You can, if you wish, perform some configuration tasks such as editing the ProofReady color and Separation configurations. When you are using ProofReady plugins, only valid configurations can be created or selected.

2.1.2 CMYK—analog matching

It is often required that your proofs are matched against an analog proofing system. In this scenario you would need ColorPro activated to create a custom color setup.

Harlequin ColorPro is supplied with a representative group of input profiles, pre-configured and ready for use, which are based on many of the traditional analog proofing systems.

Because of this extra functionality you must also make additional selections from within ColorPro to obtain the intended results. An example is shown below:

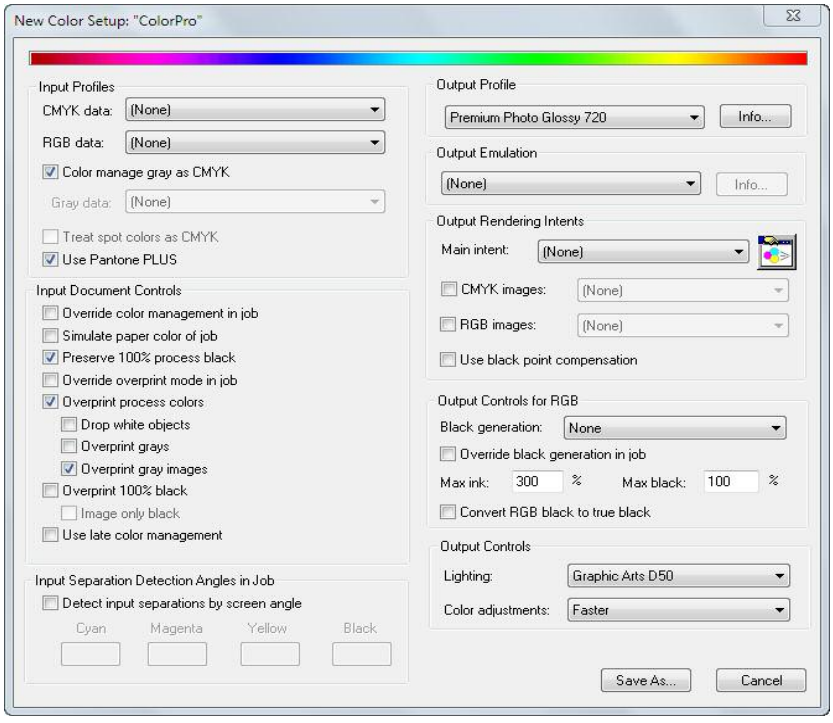

Figure 2.2 CMYK analog matching

This setup shows an input profile based on DuPont Cromalin with selection of the same Epson Stylus Pro 3800 device using glossy photo paper. Note the selection of the `->Default` rendering intent only appears when a ProofReady plugin is loaded and is the recommended choice when using ProofReady plugins.

When you create your Color Setup, remember to select the device for which you have a plugin from the **Device** menu in the Color Manager. See "Define color setups using ColorPro" on page 28 for more information.

2.1.3 CMYK—press proofing

In a CMYK workflow it is sometimes useful to make a press proof based on a standard such as SWOP or Fogra. Again, Harlequin ColorPro provides some standard profiles to make this possible. However, if you have access to an ICC profile that describes the actual behavior of the press on which the job is going to run (typically provided by a print shop), that profile should be installed into the RIP before creating a ColorPro setup. In this way the color transforms are able to achieve the most color accurate proof for your job. For more information on installing ICC profiles, see "Install ICC profiles" on page 19.

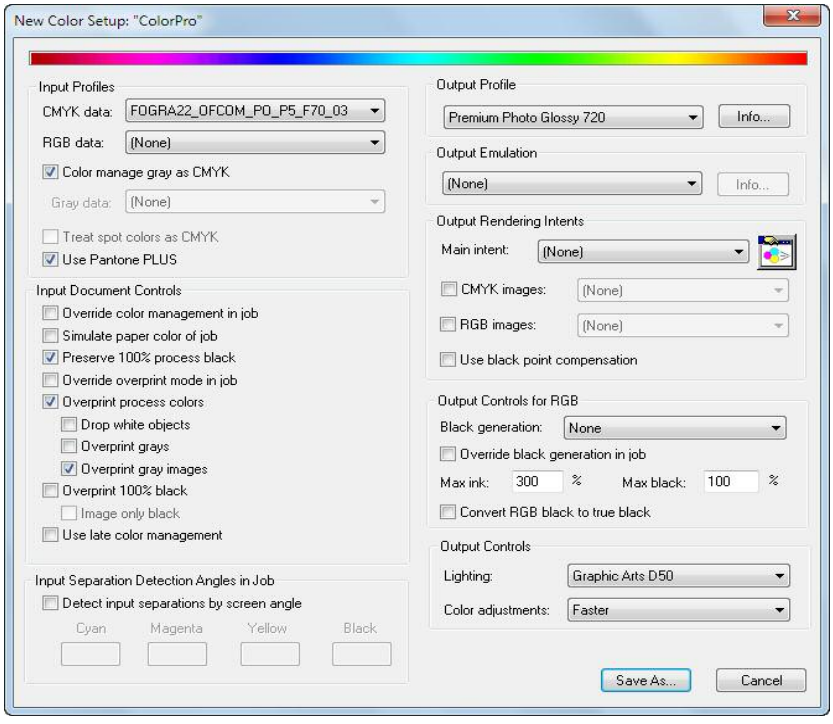

Figure 2.3 CMYK press proofing

This example shows the selection of a Fogra input profile for use with the Epson printer and again using the `-> Default` rendering intent.

The dialog below shows the GRACol_SID_GCR2 profile being installed as an input profile:

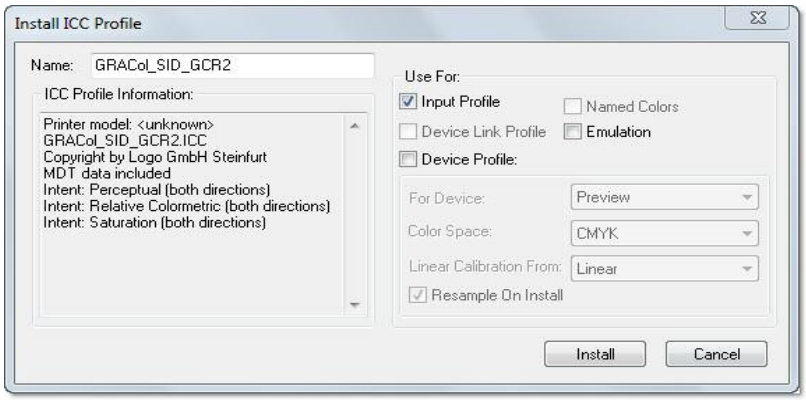

Figure 2.4 Install an input profile

The dialog below shows the GRACol_SID_GCR2 profile selected for use with the Epson printer:

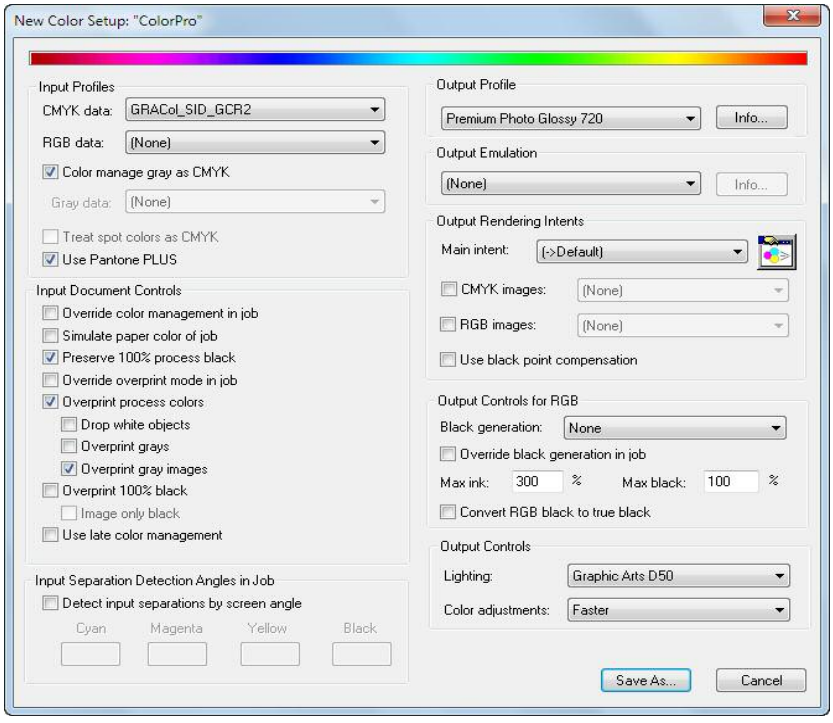

Figure 2.5 Select input profile with a printer

2.1.4 RGB Proofing—ICC model

If a customer has several editorial pages from a magazine that need to be proofed to SWOP, a magazine industry standard, a single transform will not produce a color accurate proof. This is because when you send an RGB image to the RIP and select a proofing device, the proof contains the images transformed only from the RGB color space to the color space of the proofing device. The proof will appear very colorful and pleasing to look at, due to the large color gamut of the inkjet device, however, in no way will this print be representative of what the images will look like on a printing press. Therefore, before proofing RGB images an understanding of profiles and rendering intents is required to achieve the desired results.

In the first instance, the profiles must be installed correctly and then the rendering intents should be selected. Considering an ICC workflow first. Depending on where the RGB images are coming from

you may want to install an RGB profile in the RIP to control the color transforms for all RGB images. The installation of the RGB input profile is shown below:

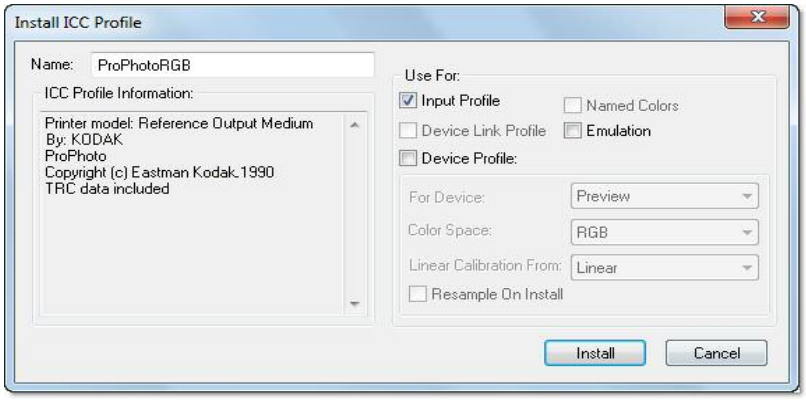

Figure 2.6 Install RGB input profile

This dialog shows the installation of a device profile:

Figure 2.7 Install a device profile

This dialog shows the installation of the emulation profile:

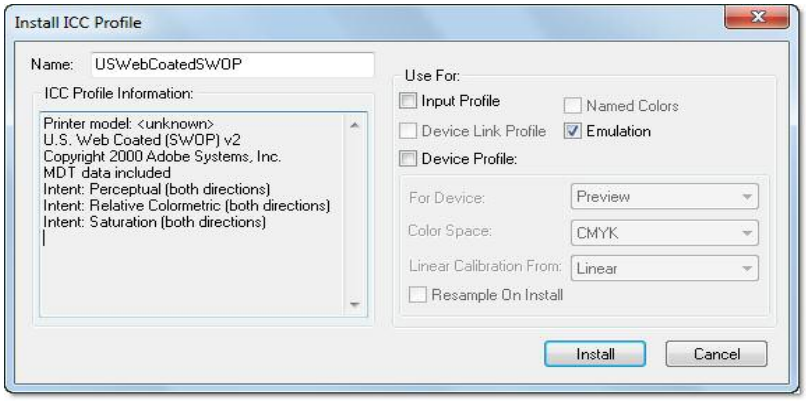

Figure 2.8 Install emulation profile

The new ColorPro emulation feature allows you to accurately proof RGB images. By selecting `Perceptual Rendering` for the first transform from RGB to SWOP, you are assured that the image is rendered to the full gamut of the press while the second transform, from SWOP to the device profile, provides the color accurate proof. Currently, the second color transform is `Absolute Colorimetric`.

The dialog below shows the ColorPro dialog configured for RGB proofing. Note the `ProPhotoRGB` input profile, the `USWebCoatedSWOP` emulation profile, the `Epson10K-Gloss-720` device profile, and the selection of `->ICC perceptual` for the rendering intent.

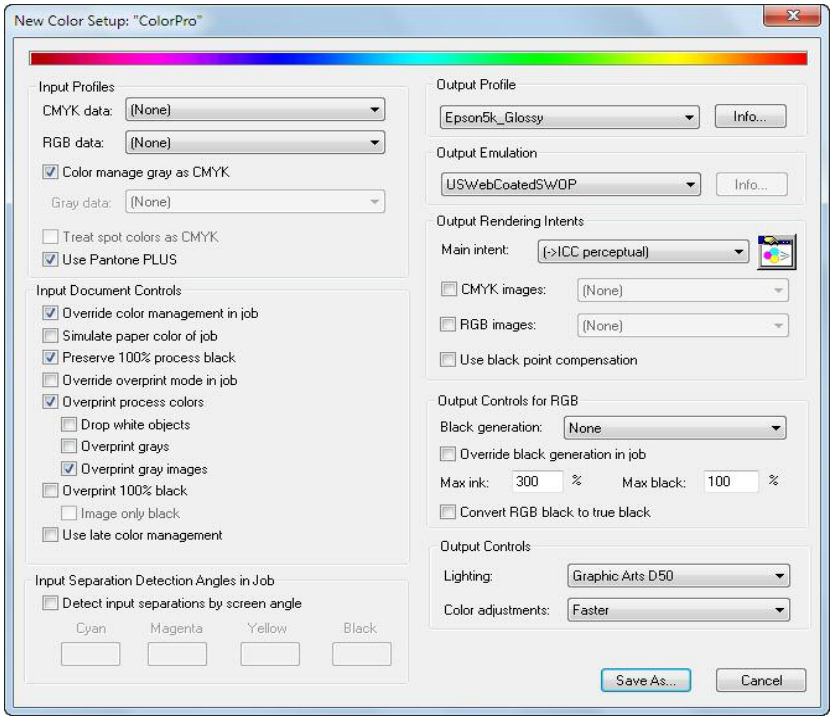

Figure 2.9 RGB proofing setup

2.1.5 RGB Proofing—SetGoldPro and Harlequin ColorPro models

The discussion on RGB proofing using the ICC model applies here. However, in this application you use the ColorPro technology within the RIP to build the color transforms as needed. This requires some additional work to build the input, emulation and output profiles using SetGoldPro, whereas in the ICC model the profiles were built using a third party application. The goal of both approaches is to obtain color accurate proofs. One approach uses third party applications to build the necessary profiles (ICC) and one uses the Global Graphics' Color utility SetGoldPro to build the profiles.

For more information on SetGoldPro, see the documentation accompanying that product.

In this model, the color accuracy is determined by the color science in the Harlequin RIP because the CRDs are generated "on the fly" as needed within the RIP and then saved for future use. A unique feature of ColorPro is that it allows you to use some ICC profiles and some Harlequin profiles, if that is your preferred solution.

One possible scenario is that you could use SetGoldPro to make an optimized output profile for a given device, ink and paper combination but use a press profile in an ICC format supplied by your

print shop. In this ColorPro setup, you use the ICC profile supplied by your print shop in the emulation slot and the Harlequin profile for the output.

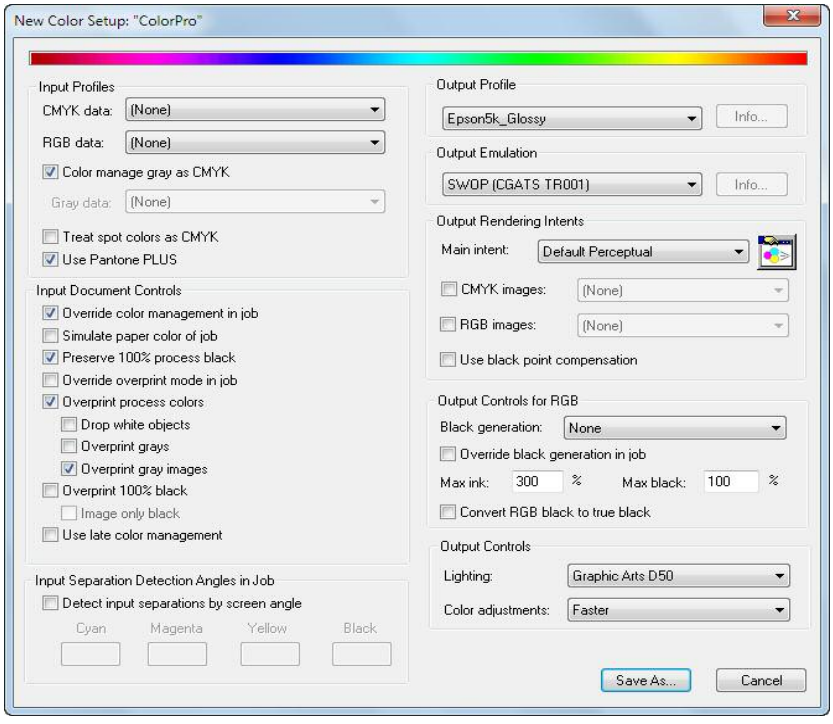

Figure 2.10 Use the emulation ICC profile supplied by print shop

2.1.6 Multiple color space proofing

Magazine publishers may receive editorial images from digital cameras which are RGB images, and ads from their vendors as CMYK images. The problem is that both editorial (RGB) and ad images (CMYK) can appear on the same page and the publisher will want to create digital proofs which are representative of what the page is going to look like on press.

With ColorPro, assuming the correct profiles and rendering intents have been selected, this type of proofing is possible. Thus a mixed color space page layout requirement can still be proofed accurately for color, allowing for the editorial group to stay in the RGB world and the ad agencies in CMYK.

Two sample setups are shown below.

This first setup uses SetGoldPro generated profiles with the exception of the RGB profile, which is an ICC profile in this example. Note that there are individual input profiles and rendering intents for

both CMYK and RGB images. (Other CMYK objects will use the Main intent.) The output emulation could be one supplied by your print shop and the output profile is for the Epson inkjet.

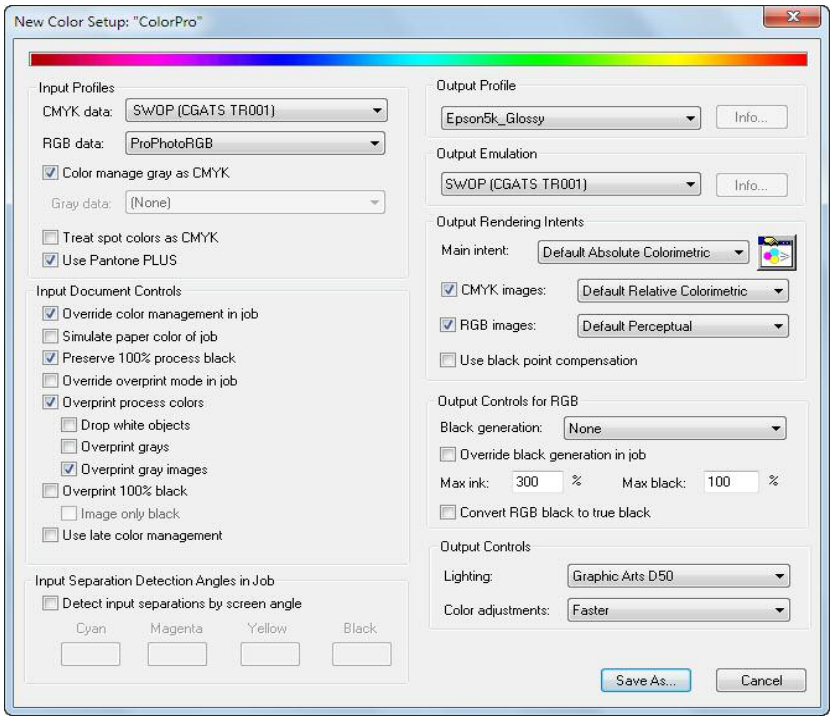

Figure 2.11 Multiple color space proofing (1)

This setup is an all ICC workflow, that is the profiles have been generated by a third party application and then loaded into the RIP.

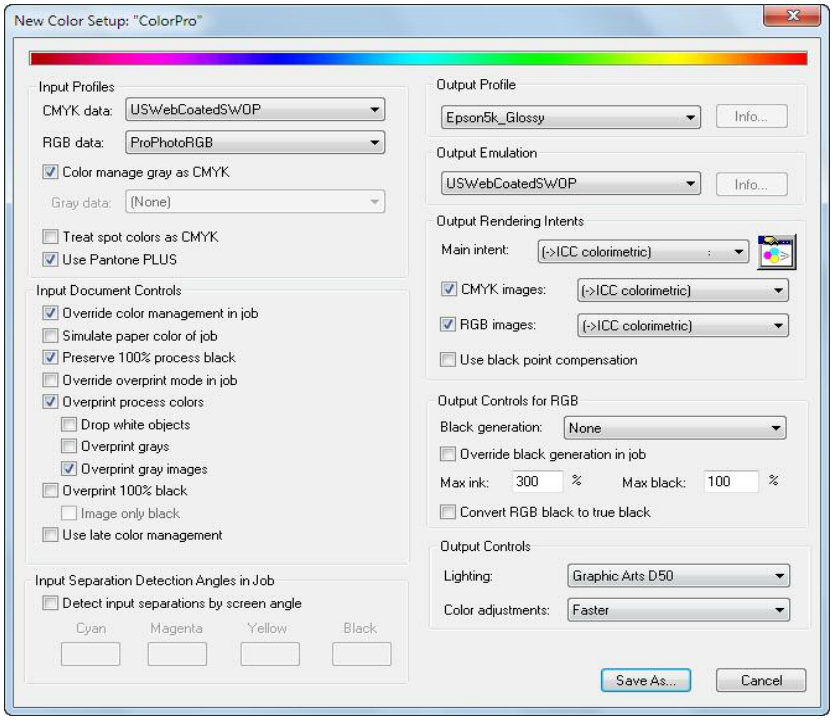

Figure 2.12 Multiple color space proofing (2)

2.1.7 Emulation workflow details

When an ICC profile is installed as an emulation profile, the RIP also installs it as an input profile, because the RIP needs to use it later in the color chain.

The chain is:

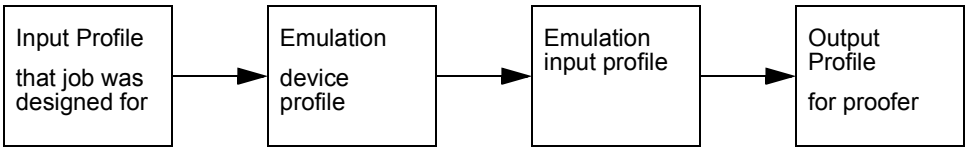

Figure 2.13 Full color chain

You only select the emulation profile once in the ColorPro setup, but it is used twice. The CRDs are used first, and then the color space is used to effectively start the second stage of the color chain.

It could be that the profile that the job was designed for is the same as the device profile that you want to emulate. That is, the job will ultimately be printed on the press that it was designed for. However, you may want to proof it on another device first.

In this case, it is reasonable to select the same input profile as the emulation profile, for example, for the CMYK input. This would still give a better route for RGB than just using an RGB input profile and the output profile of the proofer, because that does not take any account of the press it is ultimately going to be printed on.

In the case of the CMYK data, this would give a very similar result to just going from the input profile the job was designed for to the proofer profile.

The point is, selecting the same input profile as emulation profile, is mainly useful for RGB or mixed RGB/CMYK inputs. For pure CMYK inputs, you may not gain any improvement over using the color chain:

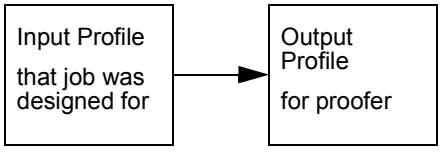

Figure 2.14 CMYK color chain

In a case where the emulation profile is not the same as the profile the job was designed for, you should expect the full (4 stage) color chain to give some benefits in that it takes account of all three profiles involved, namely, the one the job was designed for, the one it is ultimately intended to be printed on, and the proofer profile. The amount of improvement over using the color chain shown in Figure 2.14 depends on the exact profiles involved.

Chapter 3–Using Harlequin ColorPro

Harlequin ColorPro offers fully customizable color management capabilities based on the device, image components, and the color reproduction process used. When you enable Harlequin ColorPro you can use SetGoldPro profiles, ICC profiles and supplied profiles delivered with each device plugin or a combination of these if needed.

Figure 3.1 shows the whole process from installing a profile through defining custom color rendering intents to printing a job.

Note: SetGold profiles cannot be imported into ColorPro because they are not ICC profiles.

ICC profiles may be produced by OEMs or by end users with third party characterization and profiling tools. Once you have installed the ICC profiles in your system, you can use any combination of them to create customized setups. The Harlequin RIP can also use an ICC profile embedded in an image.

In addition, Harlequin ColorPro provides features that allow control over parameters used in creating color setups. These unique features include:

- Customizable color rendering intents. You can control exactly the way you want to reproduce different objects on a page by defining custom rendering intents and specifying which types of objects the intents should affect. For example, on the same page, you can simultaneously reproduce images using a perceptual rendering intent (photorealistically) and the other elements of the page using absolute colorimetry. See "Custom rendering intents" on page 25 for more information.
- Color reproduction that is adjustable based on viewing conditions. Viewing conditions available include `Graphic Arts D50`, `Monitor D65`, `Daylight`, and `Home and Office`. See Table 3.10 for more information.
- Calibrated and configurable reproduction of named PANTONE colors from the PANTONE MATCHING SYSTEM.
- Manual override capability.

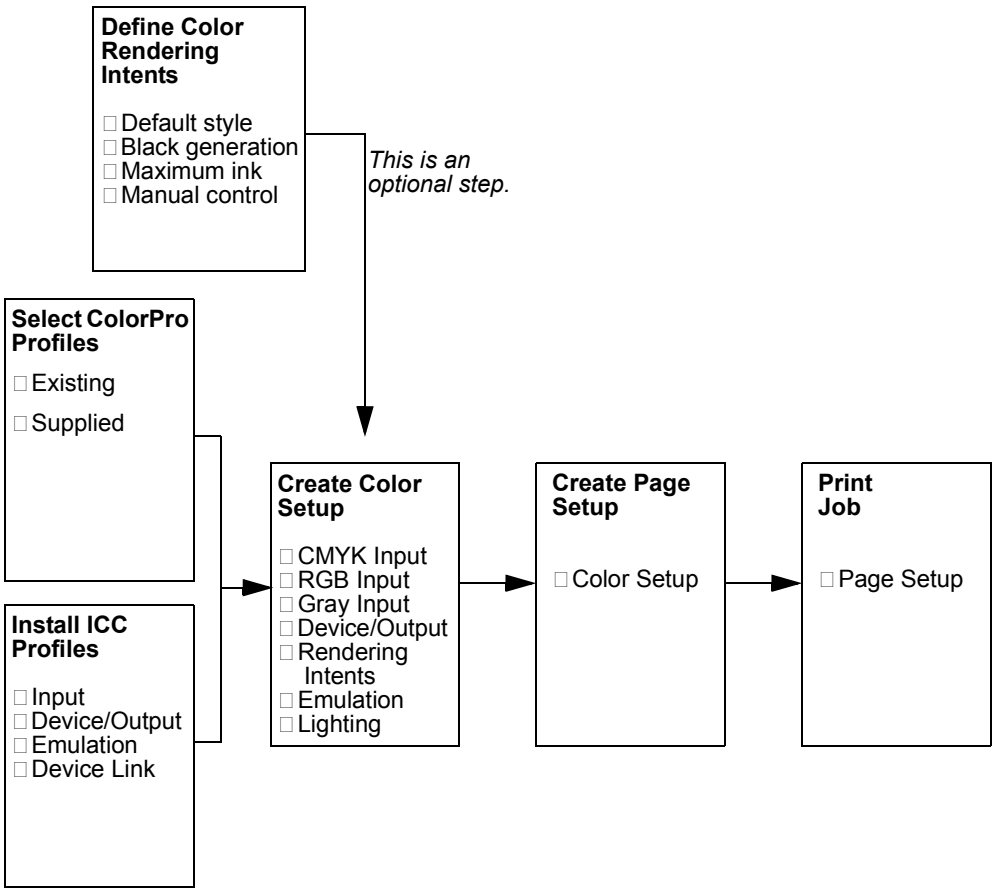

Figure 3.1 Overview of Harlequin ColorPro

3.1 Get ready to use Harlequin ColorPro

Before creating color setups using ColorPro, you must set up access to the application:

- You must have a password that enables Harlequin ColorPro. See below.

The Harlequin RIP can read the password from a file if the installation process for a plugin or other option supplied one. If the Harlequin RIP reads a password file, which it does when next starting up, it displays a dialog box with a message like this:

```
Imported password file Passwords/1234-56-7654321.pwd
```

This message only appears the first time the RIP is started.

Click **OK** to dismiss this dialog box. You can still use the manual procedures as described below as a way of enabling or checking options.

3.1.1 Enabling ColorPro for all devices

If you have a password to enable ColorPro, follow this procedure:

1. Choose **Harlequin RIP > Configure RIP**.
2. In the Configure RIP dialog box, click the **Extras** button.
3. Select `Harlequin ColorPro` and click **Add**.

4. In the Enable Feature dialog box, type or copy and paste the password that allows you access to ColorPro.

   Note: Your existing HIPP password will enable ColorPro.

5. Click OK. The Configure RIP Extras dialog box appears, with the ColorPro option enabled.

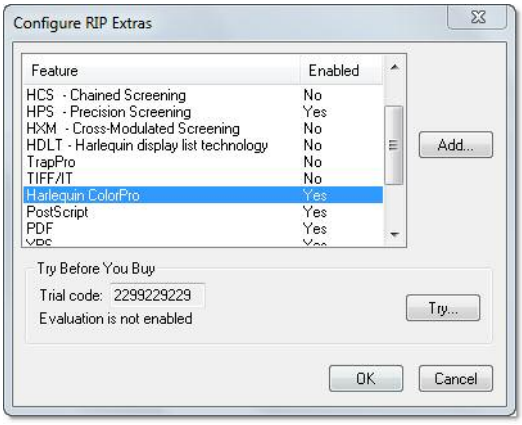

Figure 3.2 Configure RIP Extras dialog box

6. Click OK.

7. In the Configure RIP dialog box, click OK again.

You can now begin to setup the features available with ColorPro. If you have access to device profiles and various output devices, you can start using ColorPro.

3.1.2 Enabling ColorPro for a single device

If you have a password that enables HIPP for a particular device, you can use that password and ColorPro is enabled for only that device. (This enabling may have been done for you by your supplier; you can check by using this procedure.)

1. Choose Harlequin RIP > Configure RIP.

2. In the Configure RIP dialog box, click the Extras button.

3. In the Configure RIP Extras dialog box, look at the end of the Feature list.

There should be an entry starting with HCPS and of the general form:

HCPS - *devicename* [*xxxx*]

Where this entry shows *devicename*, you should see the name of the device you want to use. Where this entry shows *xxxx*, you may see HIPP, a different code, or you may see nothing (so that the entry ends in []).

There are various possibilities, as listed here:

- If there is an entry for the correct device and it ends in [HIPP], your device is already enabled for this color option. Click OK twice to close the Configure RIP dialog boxes.
- If there is an entry for the correct device, but it ends in [] instead of [HIPP], you must enable HIPP for this device. Continue this procedure at step 4.
- If there is an entry for the correct device, but it ends in a code that is not [HIPP], you must enable HIPP for this device. Continue this procedure at step 4.
- If there is no entry for the device, you must configure the device using the Device Manager dialog box. (Click OK twice to close the Configure RIP dialog boxes and see the installation guide for your chosen device. For general information, see the "Configuring Output Formats" chapter in the *Harlequin RIP OEM Manual*.) Once you have configured the output device, restart this procedure from the beginning.

4. Select the entry for the device you want to use and click Add.
5. In the Enable Feature dialog box, delete any existing number and type the password that allows you access to HIPP for this device.
6. Click OK. The Configure RIP Extras dialog box reappears.
7. Click OK. In the Configure RIP dialog box, click OK again.
8. Optionally, to check that you have enabled the option successfully, use the Harlequin RIP > Configure RIP menu option and click Extras to display the list of features again. The entry for your device should now read:

   HCPS - *devicename* [HIPP]

9. Click OK twice to close the Configure RIP Extras and Configure RIP dialog boxes.

3.2 ColorPro overview

ColorPro is designed so that you can quickly create a color setup that suits your needs. There are several steps to creating a setup; some you may or may not need. The various stages are shown below:

- Install any ICC profiles you may need. See "Install ICC profiles" on page 19. If you do not have any ICC profiles to install, this step can be skipped.
- Define any color or custom rendering intents you wish to use. See "Define color rendering intents" on page 25. If you intend to use the default rendering intents you can skip this section.
- Configure your ColorPro setup. See "Define color setups using ColorPro" on page 28. The ColorPro setup dialog is divided into several areas. The left side of the dialog handles the input and the right side handles the output. For help in deciding how to configure you workflow, see Chapter 2, "ColorPro workflows" for more information.

3.3 Install ICC profiles

Before you create color setups, you may install any ICC profiles that you expect to use. Identify the types of profiles you need and then install them.

3.3.1 Types of profiles

ICC profiles vary in how much information they contain. From a suitable ICC profile, you can install an input profile, a device (or output) profile, an emulation profile, or all three. The profile installation dialog box shows you the options and you must explicitly choose how you want to install an ICC profile (as an input profile, output profile, and so on), in order to use the profile to define a color setup.

For example, if you want to use the same ICC profile as an emulating profile in one color setup and as a device profile in another color setup, you must install the ICC profile as both an emulating profile and a device profile, by selecting both check boxes. You can, at any time, make additions to how you want to use an ICC profile. If you want to use an ICC profile (that is currently defined as an input profile only), as a device profile in a color setup, you can reinstall the ICC profile as a device profile.

Note: When a profile is installed as an emulation profile, it is automatically installed as an input profile for the appropriate color space.

You can get started using one input profile. However, Harlequin ColorPro can use various types of profiles. GGS supplies some commonly used profiles. For more information see Appendix E, "Supplied Profiles".

Input profiles for CMYK and RGB are pre-installed. If you do not have suitable profiles for your system, you must make available at least one from each of these types:

- *Input CMYK profile*. Install at least one ICC profile as a CMYK input profile or a device link profile.

  An input profile colorimetrically transforms color data from a device-dependent color space to a device-independent color space, where ColorPro options can process the data and supply it to an output profile, which you can choose separately to suit your output device.

  A device link profile maps colors between two device-dependent color spaces. In this case, the color data bypasses ColorPro color management to pass with a predefined transformation directly between the input device and the output device.

- *Input RGB profile*. Install at least one ICC profile as an RGB input profile or a device link profile. The RGB input profile translates the input to a device-independent color space so that the resulting colors match the colors that can be produced on a monitor. The device link RGB profile bypasses ColorPro color management to map the RGB colors directly to the output device.

  Note: Most ICC profiles are suitable for installation as either input or output profiles. The same profile, however, cannot be used as both a CMYK and an RGB input profile. Before you create any color setups in ColorPro make sure you have available at least one CMYK and one RGB input profile.

- *Device (or output) profile*. Install at least one ICC profile as a device (or output) profile. This profile must be an ICC output profile that is appropriate for the printer to be used. This profile does the opposite of what an input profile does. Based on information about the output device and imaging conditions, the output profile transforms the device-independent color space back into a device-dependent color space.

Note: Before you import an ICC profile into the Harlequin RIP, you should make sure that you have set up the profile correctly for the given device type in the ICC profiling package. Understanding the correct use of ICC profiles for a given device type is essential to successful color proofing.

Note: You are not able to install an ICC profile which is created for a device that has a different number of colorants to your device. For example, a six color ICC profile cannot be installed if you device only supports four colors. In addition, the colorant names must match. That is, at least one of the alternative colorant names for each device colorant must match one of the colorant names in the profile.

3.3.1.1 Calibration and output profiles

It is possible to construct color profiles starting from the different states of the output device being profiled. Two of the most common starting states are:

- The uncalibrated or "raw" state of the device.
- The device after adjustment of the individual channels for linearity, and usually with some balancing of the channels to produce a gray-balanced or neutral state; this is known as the "reference" or "golden" state. In fact, there are as many reference states as there are combinations of device, resolution, media and ink.

Note to OEM: In the production of device color characterization profiles we have found that it is good practice to make profiles relative to the reference state. We supply Harlequin RIP plugins with profiles for several combinations of resolution, media and ink.

When you install an ICC profile as a device profile, it is important to know what calibration profile was used to print the color characterization target used in the output profile making process. On import to the RIP of the ICC profile, this calibration (SetGold profile) profile must be the same as described above and selected in the Linear Calibration From option pull down menu to make the link between the Golden State of the device, contained in the SetGold profile, and the devices ICC color profile.

3.3.2 Install ICC profiles

When you have configured access to Harlequin ColorPro, you can begin installing ICC profiles.

1. Choose Color > Install ICC Profile. A normal file selection dialog box appears.
2. Enter the path where the ICC profile resides and click Select. The Install ICC Profile dialog box appears.

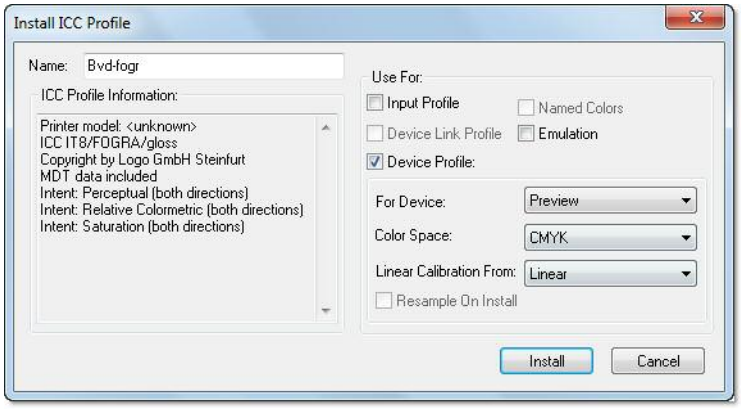

Figure 3.3 Install ICC Profile dialog box

3. In the Install ICC Profile dialog box, specify options for the profile you are installing, based on how you want to use it. See Table 3.1 for details.

Depending on the type of ICC profile, some options may be unavailable. Note that you can simultaneously install a suitable profile as an input profile, an emulation profile, and a device profile.

Field	Description
Name	Enter the name that you wish to see in other ColorPro menus when you are choosing items installed from this ICC profile. The original name shown comes from the ICC profile and may be hard to relate to the use of the profile. For example, you can edit this name so that it clearly identifies the printing conditions, by adding the name of the media and the resolution for which it is valid. The ICC Profile Information box under this field shows details about the ICC profile you are installing.
Input Profile	Select this option to install the ICC profile as an input profile (CMYK, RGB or Gray).
Named colors	Not yet available.
Device Link Profile	Select this option to install the ICC profile as a device link profile. **Note:** A device link profile maps colors between two device-dependent color spaces. In this case, the device link profile bypasses colorimetry to map colors directly between the input device and the output device.
Emulation	An emulation profile is a profile that enables an output device, such as a proofing printer, to reproduce the color characteristics of another device, such as a printing press. Because a typical proofing device has a larger gamut than a printing press, the emulation profile limits the color gamut on the proofer device to that of the device the emulation profile is for. Select this option to install the ICC profile as an emulation profile. This option is disabled if the profile being installed is a device link profile. **Note**: When you install a profile as an emulation profile, it is automatically installed as an input profile for the appropriate color space.
Device Profile	Select this option to install the ICC profile as a device (or output) profile. If you select this option, you must also choose a device from the For Device menu. Once installed with this option, the profile becomes available as an output profile in the New Color Setup dialog box.

Table 3.1 Fields in the Install ICC Profile dialog box

Field	Description
For Device	If you selected the Device Profile option, choose the output device for the device profile. If you wish to use the same profile for more than one device, you must install it for each device. When creating CMYK Separations you should select `Printing Press`.
Color space	This is the color space of the profile. Generally profiles are provided for a single color space. However, some profiles are supplied for more than one color space. In this case you should select the color space which you would like to use.
Linear Calibration From	Once you have made a choice in the For Device menu, choose an entry from this menu. Each entry is a profile associated with the device, and used here to provide a calibration. Choose the profile from which you want to copy the calibration. • Choose `Linear` if the ICC profile you are installing has been made relative to the raw state of the device. • Otherwise, choose the reference state indicated by your profile manufacturer. Typically, the name of a profile in the menu gives enough information to match it with the ICC profile information of the profile you are installing. • **Note**: When a device using a ProofReady profile is selected in the For device field, the Linear Calibration From menu offers various media options available for that printer and as such provides calibration for that particular device and media combination.
Resample on Install	This option enables resampling and is not always available. When selected it reduces the size of the profile you are installing. However, resampling also means less accurate color reproduction if you mean to use the rendering dictionaries in ColorPro. You must assess your situation and decide accordingly.

Table 3.1 Fields in the Install ICC Profile dialog box *(Continued)*

Note to OEMs: You may need to alter the second bullet point in the description of Linear Calibration From, to match what you supply to your users. If you have a new combination of device, resolution, media, ink, or other parameters that affect your imaging characteristics, you can make your own reference state, as indicated in technical note Hqn042 and the document *aimvalue.pdf*, supplied with the Harlequin RIP Extensions Manual. If you use an output plugin created by GGS and supply your users with the installed profiles supplied by GGS, then the naming of the profiles shown in the Linear Calibration From menu indicates the device, media and resolution. If you supply additional ICC profiles, one simple option

is to create each ICC profile by printing an ICC target using the appropriate Harlequin profile and following a similar naming policy for the resulting ICC profile.

To resume the process, follow these steps:

4. Click Install to install the profile.

   The Harlequin RIP runs a short job to do this, typically taking under 10 seconds. This job produces no output but does display an activity icon in the status area of the RIP tool bar.

5. Repeat this procedure from step 1 to install any other ICC profiles that you wish to use. Unless you are using device link profiles, ColorPro must have available one of each of these three profile types: input CMYK profile, input RGB profile, and a device (or output) profile.

3.3.3 Uninstall ICC profiles

A method is provided to uninstall ICC profiles.

1. Select the Color > Uninstall ICC Profiles... menu item. On selection the following dialog appears:

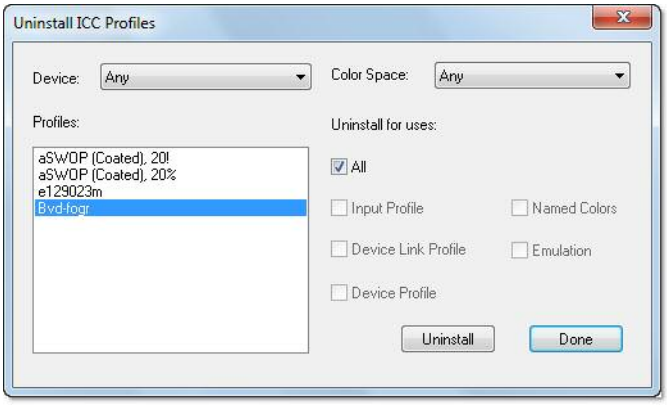

Figure 3.4 Uninstall ICC profiles

2. Use the Device and Color Space menus at the top of the dialog to limit the list of profiles to a particular device and color space.

   Note: Input profiles are not device specific so appear whatever the Device selector is set to.

   The related profiles appear in the main Profile window.

   Note: The profile list only shows ICC profiles, that is, those containing the `%%ICC Profile` tag. See Note on ProofReady profiles below.

3. The Uninstall for uses check boxes allow uninstallation for *All* uses of the selected profiles, or just some. The check boxes are only enabled when there are profiles selected. If All is selected, the five individual use check-boxes are all disabled, otherwise they are enabled if at least one of the selected profiles is installed for that use. For example, if none of the selected profiles were installed for emulation, the Emulation check box is disabled.

4. Click on the Uninstall button to uninstall the selected profiles. The Uninstall button is only enabled when there are profiles selected.

5. To close the dialog click the Done button. The dialog is not automatically closed after clicking Uninstall.

   Note: You are unable to uninstall ICC profiles that are being used by color setups. If an attempt is made to uninstall such a profile a message is displayed:

```
Unable to uninstall the profile '<profile name>' because it is used by the color
setup '<color setup name>'
```

For example;

```
Unable to uninstall the profile 'Bvd-fogr'because it is used by the color setup 'bvd'
```

Note: If the same profile is used by several setups, the error message shows only one setup at a time, and not all the setups the profile is used for.

Note: A profile is deemed as being a ProofReady profile if it has the `/ExternalCRDs` PSIO (PostScript Input/Output) key. Whether it is an ICC profile (has the `%%ICCProfile` tag), and the value of any `%%Creator` tag are no longer relevant.

ProofReady profiles are omitted from the list of profiles that can be uninstalled. For a profile to be recognized as a ProofReady profile it must have the `/ExternalCRDs` key.

To identify a profile which you have created, you should add, (for example), `"%%Creator: <OEM name>"`.

3.4 Define color rendering intents

If you are building a color setup for a new device, custom rendering intents are useful for optimizing the color and quality of the proof based on the ink, paper, resolution and screening combination. Custom rendering intents are used to optimize the CRDs when making color setups for a new device. They are then used a second time to globally adjust the color to satisfy customer requirements.

When ColorPro is enabled you can define custom color rendering intents, but this is not essential at first use of Harlequin ColorPro because you can get good results using the default rendering intents or ProofReady plugins.

ColorPro is supplied with default rendering intents that you can use immediately. Each default rendering intent has a name that closely matches the style on which it is based, and the styles correspond to, but are independent of, the names of intents supplied in ICC profiles. For example, the *Default Perceptual* rendering intent uses the *Perceptual* style.

If you want to use only default rendering intents or rendering intents derived from ICC profiles, see "Install ICC profiles" on page 19 or "Define color setups using ColorPro" on page 28. You can return to the remainder of this section if you want to go ahead and create a custom rendering intent.

Note: The `->Default` rendering intent cannot be edited using the Rendering Intent Manager. This is because it is already a CRD created with specific settings.

3.4.1 Custom rendering intents

You define a custom color rendering intent by specifying combinations of settings to be used with a style.

Some settings allow you to achieve the intention of the style in a way that best suits the technology of a particular output device without having a significant visual effect. For example, you can alter the black generation strategy. Other settings allow you to modify the visual appearance of the result, but move away from being strictly colorimetric.

Custom rendering intents are used in combination with SetGoldPro output profiles when building profiles for a new device and to adjust color to meet customer requirements.

Follow these steps to create customized intents.

1. Choose Color > Color Rendering Intent Manager. The Color Rendering Intent Manager dialog box appears.

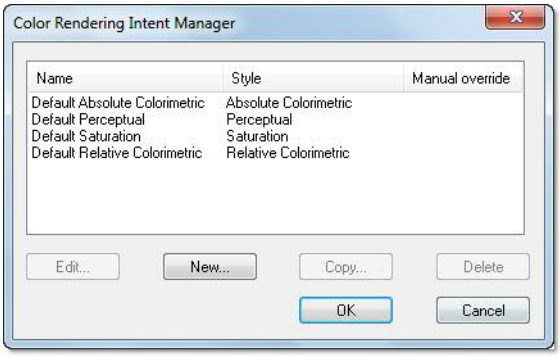

Figure 3.5 Color Rendering Intent Manager dialog box

We recommend that you do not edit the default entries. Use the **New** or **Copy** buttons to create new intents before making changes.

2. Click **New**.

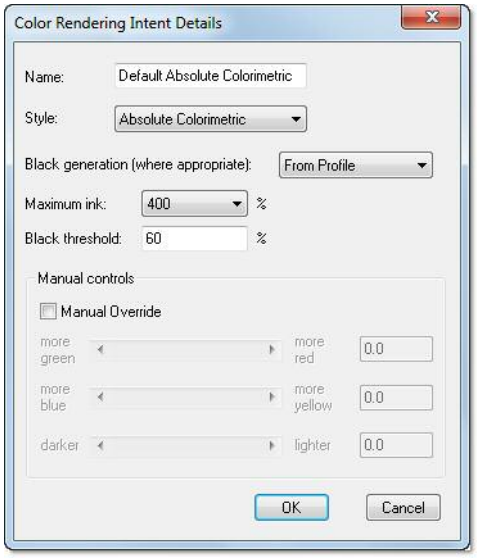

Figure 3.6 Color Rendering Intent Details dialog box

3. In the Color Rendering Intent Details dialog box, you can set options for the intent you are defining. See Table 3.2 for descriptions of each option.

   Note: When any of the ColorPro options are applied, the Harlequin RIP disregards the Black generation UCR settings in the **Output Controls for RGB** section of the New Color Setup dialog box. Instead, it generates black based on the values chosen in the Black generation and Maximum ink fields in the Color Rendering Intent Details dialog box. See Appendix A, "UCR and Black Generation" for details.

Field	Description
Name	Enter any name for the intent you are defining. Choose a meaningful name.
Style	Select a style from the menu. Choose one of the following: `Absolute Colorimetric`—Applies absolute colorimetric rendering. `Perceptual`—Applies photorealistic rendering and is especially suitable for contone images. `Relative Colorimetric`—Applies relative colorimetric rendering when absolute colorimetric rendering cannot be achieved (due to output device limitations). `Saturation`—Applies highly saturated eye-catching colors. Suitable for charts, presentations, and business graphics. `Default`—Appears only when a ProofReady plugin is installed and selected. Applies to ProofReady plugins and is optimized for the selected printer. See "Color mapping styles used in ColorPro" on page 3 for detailed descriptions of these styles.
Black generation (where appropriate)	This option determines how much black ink should be used to reproduce colors. Select `Minimum`, `Light`, `Medium`, `Heavy`, or `Maximum` from the menu. The `From Profile` option allows black generation to be defined in the profile.
Maximum ink	This option sets a limit on the amount of ink. Select from `200%` to `400%` in `20%` steps from the menu.
Black threshold	Value range should be `0-100%` with decimals not necessary (`95.5%` defaults to `96%`). Leaving black threshold at its default value of `60%` means black starts at a `60%` tone value within the image. Black generation must be set at least to `Light`, for Black threshold to have an effect.
Manual Override	This allows you to apply customized color corrections. You are redefining the rendering intent by using the slider to make the image more green or red; more blue or yellow and lighter or darker. For each type of correction, use the slider or enter a value in the range of `-100` to `+100`. **Note:** Using this option without adequate knowledge can result in distorted output.

Table 3.2 Color Rendering Intent Details dialog box

4. Click **OK** after you have set options for the intent you are defining. The Color Rendering Intent Manager dialog box displays the intent you defined. You can also copy, edit, or delete intents from the Color Rendering Intent Manager dialog box.

5. Click **OK** to close the Color Rendering Intent Manager dialog box.

3.5 Define color setups using ColorPro

You can use any ICC profiles or Harlequin derived profiles with any suitable rendering intents, (ICC, Default Absolute Colorimetric, and so on, or customized intents) to define color setups in ColorPro. Follow these steps to create a customized color setup. Note that a color setup corresponds to a particular device and color space.

1. Choose **Color > Color Setup Manager**. The Color Setup Manager dialog appears.

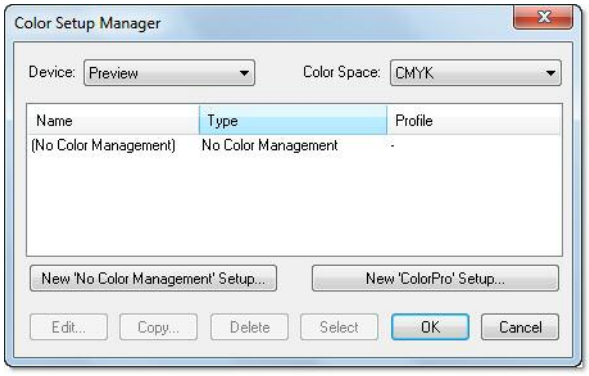

Figure 3.7 Color Setup Manager dialog box

2. In the Color Setup Manager dialog box, select the device for which you want to create a color setup. If you are creating a color setup for CMYK Separations you should select `Printing Press`.

3. If necessary, select the color space for which you want to create this color setup. Note that when you create a page setup, the separations style you choose determines the color space of the page setup.

4. At this point you have the option to select either, **New 'No Color Management' setup**, details of which you can find under the *Color Setup* heading in *Section 12* of the *OEM manual* (because it is available to all), or **New 'ColorPro' setup** (only available by use of a password) which is detailed here.

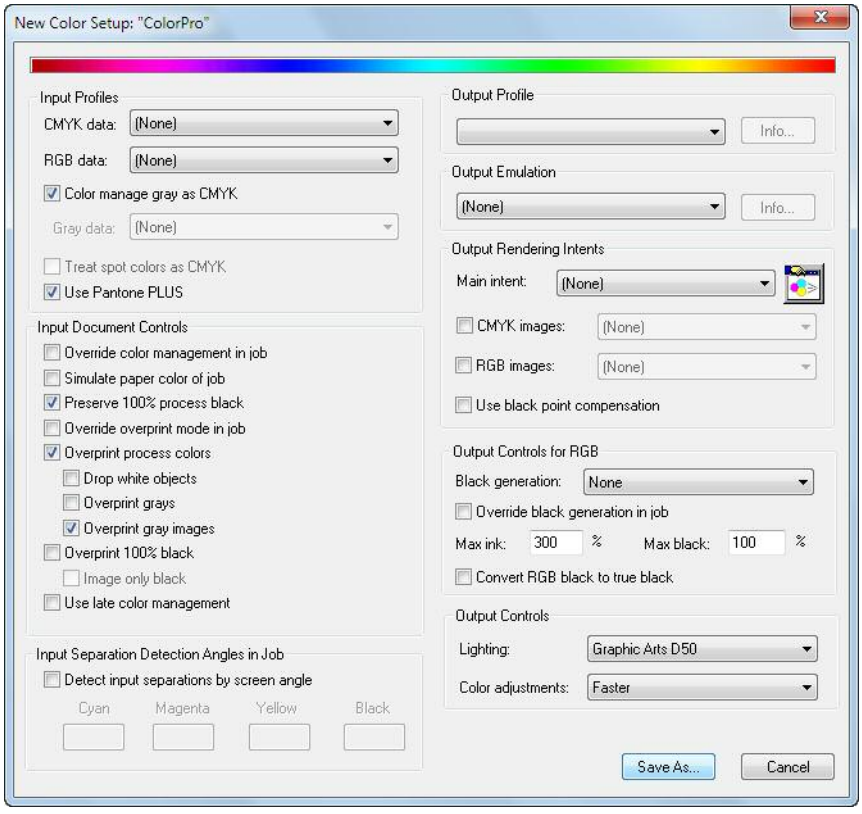

Figure 3.8 New Color Setup "ColorPro" dialog box

5. The options on the left side of this dialog handle the input and the options on the right side handle the output. The following tables describe the options available in this dialog. Choose the options for the color setup you are defining. We recommend that you select the **Output Profile** first; it can affect choices in other fields.

   Unless you have a device link profile selected as an input profile, you *must* specify options in the **Output Profile** and the **Rendering Intents** menus before saving this color setup.

   Note: The options shown in this dialog box always take effect for jobs that do not contain color management information. If the job contains color management, you must select the **Override color management in job** check box if you want to use the RIP color management options.

The following table describes the Input Profiles section of the New Color Setup dialog box:

Fields	Description
CMYK Data	From the menu, select an input or device link profile for all CMYK data including scanned images, line art, text, and graphics. The list includes `(None)`, all Harlequin-produced profiles (such as `DuPont Cromalin` and `3M Matchprint`), and any installed ICC profiles. Device link profiles display a double-sided arrow (`<->`) next to the device link name. Appendix E.1, "CMYK Input Profiles" describes all supplied CMYK input profiles. If you select `(None)`, CMYK colors are treated as device-dependent color and subject to the PostScript Level 1 rules for conversions.
RGB Data	From the menu, select an input or device link profile for all RGB data including scanned images, line art, text, and graphics. The list includes `(None)` for device-dependent color, all Harlequin-produced profiles (including `Trinitron`, `Office Graphics RGB` and `sRGB`), and any installed ICC profiles. Appendix E.2, "RGB Input Profiles" describes all supplied RGB input profiles.
Color manage gray as CMYK	By selecting this option, monochrome (gray) data uses the input profile selected in the CMYK data field and is color managed as CMYK. When this option is selected the Gray data menu becomes unavailable. If this option is unchecked, the selection in the Gray data field is used.
Gray data	From the menu, select either `None` or any gray profile you have installed. Incoming gray data uses the selected profile unless you choose `None`, in which case gray data does not have any color management. Gray ICC profiles can be created from Photoshop v6.5, exported and then installed into the RIP.
Treat spot colors as CMYK	When an input profile has been selected in the CMYK data field, this option becomes available. Checking this option makes any spot color in the job use the input profile specified in the CMYK data field. When this checkbox is disabled, spot colors will always be treated as CMYK. If this option is not selected, the Pantone color is chosen using the XYZ Pantone lookup table (within the RIP), which in turn gives the proof a best match for the Pantone color but is not indicative of what the color will look like on press. See "Use late color management" on page 34 for more information.

Table 3.3 Input Profiles

Fields	Description
Use Pantone PLUS	Support for Pantone PLUS, which is an extension to the pre-existing Pantone color sets. The Pantone PLUS option is checked by default. Setups migrated from previous versions should uncheck this option to maintain previous behavior.

Table 3.3 Input Profiles

The following table describes all the options available in the Input Document Controls section of the New Color Setup dialog box.

Fields	**Description**
Override color management in job	Select this check box to override any color management supplied in the job and use the options set in this dialog box. If you do not select this check box, the Harlequin RIP searches the job for a color space array, embedded ICC profile, or a color space resource. If there is such an element, the Harlequin RIP uses it to transform the relevant object on the page and then treats the object as defined in device-independent color. See Appendix C, "Jobs Containing Color Management Data" for details. **Note**: A PDF/X-3 file containing an `OutputIntents` dictionary will be color managed using the ICC profile indicated by the `OutputIntents` dictionary, as long as the job uses a device independent color space and the Override color management in job option is not selected
Simulate paper color of job	Select this check box if you want the output device to lay down a background which matches the paper base color of the input. If you do not select this check box, colors are adjusted so that the white base is mapped to the (final) printer's paper color. **Note:** This check box determines the rendering style the Harlequin RIP uses with the `ICC colorimetric` intent. It is absolute colorimetric when this box is selected, relative when de-selected.
Preserve 100% process black	Select this check box if you do not want the black-only part of your input to be converted to a CMYK-equivalent color. This option is particularly relevant for black text because it avoids colored fringes.

Table 3.4 Input Document Controls

Fields	Description
Override overprint mode in job	There is a new PostScript operator called `setoverprintmode` which is the PostScript equivalent of the PDF gstate `OPM` flag. If an object is set to overprint and `OPM` or `setoverprintmode` is on, the Harlequin RIP drops any colorants which have a zero value. This is called "implicit overprinting". This is what the **Override overprint mode in job** option controls. If the **Override overprint mode in job** option is selected, the **Overprint process colors** option (described below) is always honored and any `overprintmode` and `OPM` parameter in the job is ignored. If it is not selected, any `overprintmode` and `OPM` parameter in the job is used and the **Overprint process colors** setting is used as the default value. For more information see Appendix D, "Overprinting options".
Overprint process colors	If this option is selected and overprinting is switched on for an object, the RIP overprints any process color component defined as `0` in the CMYK color space, or as `1` in the RGB color space. That is, the component is treated as transparent. When this option is not selected, a process color component produces a knockout on the separation. However, if overprinting is switched on for an object, the RIP overprints colorants that are explicitly set to overprint using the Harlequin extension `setcmykcolor`. For more information see Appendix D, "Overprinting options".
Drop white objects	When **Overprint process colors** is selected, **Drop white objects** determines how the RIP handles white objects: objects defined as `0 0 0 0 setcmykcolor`, `1 setgray`, or `1 1 1 setrgbcolor`. If this option is selected and overprinting is switched on for that object, the white object simply disappears from the separations. If this option is not selected, the white object knocks out underlying objects, even when overprinting is switched on. By default, this option is not selected. For more information see Appendix D, "Overprinting options".

Table 3.4 Input Document Controls *(Continued)*

Fields	Description
Overprint grays	Select this option to enable the cyan, magenta, and yellow colorants to be overprinted rather than knocked out when a color is specified as gray (with the PostScript language `setgray` operator or spot color converted to a gray level), and the job requests overprinting. This behavior is not defined by the PostScript language, and though it is unusual for a job to rely on it, sometimes a job assumes this, especially when the gray tint arises from a named black spot color which is converted to process. For more information see Appendix D, "Overprinting options".
Overprint gray images	Overprint behavior changed from Harlequin RIP version 4.1 to 5.x and beyond. While the old behavior is deemed incorrect, there is a desire to selectively use the old behavior because of the un-predictability of some graphic applications and to provide for end-users the ability to handle legacy work. The user parameter is called `OverprintGrayImages`, with a default of `true` which when set overprints gray images. If it is set to `false`, gray images will knock out of CMY backgrounds.
Overprint 100% black	When this option is selected, the RIP overprints 100% black rather then generating knockouts in the other separations. The black channel or separation is generated as normal but, depending upon the characteristics of the other inks, may need to be applied last in the combination process so that it overprints all colors necessary. If this option is selected, overprinting occurs regardless of whether overprinting is switched on for that graphics object. How the overprinting of the other separations is done depends on the **Image only black** option. There is no performance penalty incurred by using this feature—in fact, it may be slightly faster to overprint, given that knockouts do not have to be calculated. This feature only applies to black objects, not to individual pixels of a continuous tone image that happen to be 100% black.

Table 3.4 Input Document Controls *(Continued)*

Fields	Description
Image only black	This option controls whether solid black objects appear in the process color separations other than Black when the Overprint 100% black option is selected. If this box is selected, the RIP ignores the other process color components of black objects and no trace of the objects appears in those separations. If this box is not selected, the other process color components are taken into account. If this box is not selected, the objects appear in any separation where the color component is defined as non-zero in the CMYK color space (or not 1 in the RGB color space). Process color components defined as 0 in the CMYK color space or 1 in the RGB color space are always overprinted.
Use late color management	Color management modules prior to the Harlequin RIP Genesis Release™ instigated color management at the front-end of the process, (with the exception of recombine jobs where color management was applied at the back-end of the process). Applying late color management gives better quality results with blended colors. See below for more information.

Table 3.4 Input Document Controls *(Continued)*

Notes on Use late color management

The Use late color management option has been introduced in the Harlequin Genesis Release™ to overcome problems with color managing blended colors. In this context, blended colors means both the compositing of transparency in PDF jobs, and also the overprinting of opaque objects in PostScript language and PDF files.

In order to color manage blending correctly, the blending must be performed in the same color space that the designer worked in when creating the job. For example, SWOP with a range of Pantone colors. In theory, if this type of job is printed on a SWOP press that supports all the Pantone colors present in the job, the rendering of the blends will be correct.

Problems arise when the job is printed to a device with different characteristics to the color space the designer worked in. A typical usage is the need to color manage the job when printing to a proofing device. In this case, to reproduce the blending the designer intended, the blending should be performed in SWOP and result then color managed to the proofing device. Historically, this has been difficult to do accurately without using a form of "double pass" RIP processing. That is, the job is RIP processed once to (for example) TIFF, in which the blending is in SWOP. The second RIP pass then color converts the TIFF and outputs the result to the proofing device.

When the Use late color management option is off, the Harlequin RIP will perform color management of colors in the job before blending of either transparency or overprints. The RIP performs blending by using the available information to make a "best guess" at the blended colors, but at a late stage in the RIP process and without full knowledge of the color values and other graphics state attributes. This method usually makes the blended regions visible, although they are not correctly color managed. And if spot colorants are converted to process colors, overprinting of these objects is disabled by default.

When the Use late color management option is selected, color managed blending is performed in a single pass of RIP processing with its obvious efficiency benefits. The Use late color management option is available on both ColorPro and No color management color setups.

The option is available in No color management setups to achieve better rendering of overprinted spot colors. For accurate proofing of jobs containing transparency and/or overprints, it is recommended that the Use late color management option is used.

Please note the following points when using late color management:

- The definitions of tint transforms of spot colors in the job (which are used to derive the CMYK equivalents) will only be used to derive the CMYK equivalent of the 100% color value. Tints will be rendered with CMYK values derived from the 100% spot.

  Note: If the Treat spot colors as CMYK option in a ColorPro setup is off (the default), the RIP attempts to find the equivalent from the spot color databases in preference to using the tint transform. That is long-standing ColorPro behavior. See Table 3.3 for more information.

- If a job contains multiple color spaces of the same spot color, and where there are multiple definitions of the tint transform, only the first tint transform encountered will be used; as above.

- Special treatment of `DeviceRGB` and device independent colors in the job is currently required. That is, the RIP will first color manage these color spaces to a CMYK color space defined by the CMYK input profile. If this is not defined, or a No color management setup is used, `SWOP (CGATS TR001)` will be used. The downside of this method is that the CMYK input profile may restrict the gamut of the colors in the job for these color spaces to less than the gamut of the output device.

- Using the Preserve 100% process black option at the same time as Use late color management will sometimes give undesired results.

- Late color management is forced on when used with recombine and also when outputting to a `DeviceN` device, such as a Hexachrome device.

The following table describes all the options available in the Input Separation Detection Angles in Job section of the New Color Setup dialog box.

Fields	Description
Detect input separations by screen angle	The RIP sometimes needs to identify which colors are represented in jobs: for example, when recombining a preseparated job. Most pre separated jobs have PlateColor comments. Therefore, from v8.3 separation detection by angle has been turned off by default. Where there is not an obvious identifier, most likely in legacy jobs, the RIP can use the screen angle as one of the items that the RIP analyzes. Turn this option on to detect separations by screen angle.
Cyan Magenta Yellow Black	The angles specified in these fields help the ColorPro application detect the individual plates within a job. The default angles usually work. If you do change one of these values, for example Cyan to `30°`, and the incoming job has Cyan at `15°`, you will encounter problems.

Table 3.5 Input Separation Detection Angles in Job

The following table describes the Output Profile option of the New Color Setup dialog box.

Fields	Description
Output Profile	From the menu, select an output profile for your device. All GGS supplied profiles and installed ICC profiles for the selected device are displayed. After you select an output profile, you can click the Info button to display the characteristics of the output profile. Verify that you have chosen the appropriate profile.

Table 3.6 Output Profile

The following table describes the Output Emulation option of the New Color Setup dialog box

Fields	Description
Output Emulation	Emulation is used when you proof on a different device to that used for final output, because a typical proofing device has a larger color gamut than a printing press. Using an emulation profile, the proofer limits the range of colors so that it prints to the gamut of the device being emulated. For example, if you are proofing on an inkjet printer, you can use a profile of your printing press to emulate, on the proofer, the characteristics of the press. If you specify an emulation profile, the chosen rendering intents are applied to the emulation profile, and not the proofer profile. When you have selected an emulation profile, you can click the Info button to display the characteristics of the profile. Verify that you have chosen the appropriate profile. Note that only CMYK profiles are available in this menu because RGB and Gray emulation profiles cannot currently be handled.

Table 3.7 Output Emulation

The following table describes the Output Rendering Intents options of the New Color Setup dialog box:

Fields	Description

Main intent	You should select a rendering intent from the menu. This is the rendering intent which is used for all objects, unless you have specifically chosen a rendering intent for CMYK or RGB images (described below).
	
	The list depends on the choice of emulation profile, but does not include it.
	
	The ICC rendering intents are those appropriate to the output profile selected, (or if you have selected an emulation profile, they are appropriate to the emulation profile selected).
	
	The list includes `(None)`, the default intents and any custom intents you created (as described in "Define color rendering intents" on page 25), and usually:
	`(->ICC perceptual),`
	`(->ICC saturation),`
	`(->ICC colorimetric).`
	
	You can select the button to the right of the option to display the Color Rendering Intent Manager from which you can create new rendering intents, see "Define color rendering intents" on page 25 for more information.
	
	See "Color mapping styles used in ColorPro" on page 3 for detailed descriptions of all intents (styles).

Main intent (cont)	If you select an ICC output profile, `ICC auto-switching` becomes an available option. ICC auto-switching intelligently assigns different rendering intents based on the image types within a file. CMYK images are set to ICC colorimetric. RGB images are set to ICC perceptual.
CMYK Images	This option overrides any selection you made in the Main intent field but for images only. It applies to all images including Gray a? d RGB images. If required however, you can select an option specifically for RGB images from the **RGB Images** intent menu (below) which overrides this intent with its own option (described below). The list of options displayed in the menu work in the same way as for the Main intent. If you decide not to select a rendering intent for CMYK images, the Main rendering intent is used instead.

Table 3.8 Output Rendering Intents

Fields	Description
RGB Images	When you select an option from this menu you are effectively overriding, for RGB images only, the options previously configured in the CMYK Images menu, or if no option is selected there, the Main Intent menu (described above). The list of options displayed in this menu work in the same way as for the Main Intent. If you decide not to select a rendering intent for RGB images, the CMYK rendering intent is used. And if an option is not selected there, the Main rendering intent is used.
Use black point compensation	From v8.0r0 Black point compensation has been added to ColorPro and is compatible with the Adobe implementation. Black point compensation is used when converting images from the color space of one device to the color space of another device. It accounts for the differences in the darkest level of black which can be printed on those devices. The implementation in the RIP will only work with color transforms composed entirely of ICC profiles, that is, the method will have no effect on device independent color spaces such as CalGray, CalRGB, CIEBasedxxx, but will work for ICCBased and embedded ICC profiles. Also, the ICC profiles supplied in setreproduction must be installed in a v8.0r0 RIP, that is, the method will have no effect on output profiles migrated from earlier versions of the RIP.

Table 3.8 Output Rendering Intents

The following table describes the Output Controls for RGB options in the New Color Setup dialog box

Fields	Description
	Note: None of the options in this section are available if an RGB profile is selected from the RGB data menu in the Input Profiles section.
Black generation	This is the process of computing how much, and where, black should be added to the image. This option determines how much black ink should be used to reproduce colors. Select `Ignore`, `Minimum`, `Light`, `Medium`, `Heavy`, `Maximum` or `UCR` from the menu. *Undercolor removal* (UCR) is the process of reducing the amount of other colors present where the black is added.
Override black generation in job	Rarely, a job specifies black generation itself. You can force the scheme set in the Color Setup dialog box to override those set by the job, by selecting this check box.

Table 3.9 Output Controls for RGB

Fields	Description
Max. ink	This value constrains the maximum amount of all four CMYK colors that are generated in the conversion process. Similarly, colors specified explicitly as black are not affected by this.
Max. black	This value is the maximum amount of black ink that is generated by the color conversion process. Note that colors specified explicitly as black are not affected by this setting.
Convert RGB to true black	Some applications, and especially Microsoft® Word, use RGB colors for everything, including solid black—coded as `0 0 0 setrgbcolor` (or `0 0 0` in a `DeviceRGB` color space). You should choose this option to force the RIP to intercept blacks coded in this way and convert them to (`0 0 0 1`) in a CMYK color space.

Table 3.9 Output Controls for RGB

The following table describes the Output Controls options in the New Color Setup dialog box.

Fields	Description
Lighting	ColorPro provides compensation control over the local viewing conditions which include `Graphic Arts D50, Monitor D65, Daylight, Home and Office`. Much graphic arts work uses D50 illumination throughout the process to minimize transforms when converting data through the color chain. Thus, targets are measured with `D50`, colors are transformed from input to output through the ICC (profile connection space), PCS in `D50`, and the proofs are viewed under `D50` illumination. However, some systems have alternative methods which include `D65` viewing boxes and sometimes no lighting system for viewing prints at all. The lighting options are provided to help someone who knows that the proofs are going to be viewed in a non-traditional `D50` lighting situation and has some idea how they are going to be viewed.

Table 3.10 Output Controls

Fields	Description
Color adjustments	From v8.0r0 the `Faster` and `Accurate` image color adjustment methods have been replaced to use a different algorithm that is much more predictable than the previous versions. The `Faster` algorithm no longer uses the error scattering method which avoids problems with the compressibility of the final output. The `Faster` algorithm will improve performance of 3+ component images, but will particularly improve CMYK images. All three options use the same interpolation algorithm, the only difference is the number of grid points per colorant. There is always a difference between the three methods, with `Accurate` being the most accurate and slower, while `Faster` is always faster and less accurate. The `Better` option sits somewhere between `Accurate` and `Faster` with regard to quality and speed. However, `Faster` may well be accurate enough for most purposes. The only method of finding out which is most suitable for a particular purpose is to experiment.

Table 3.10 Output Controls

6. After setting options in the New Color Setup dialog box, click Save As and assign a name to this color setup. The Color Setup Manager dialog box displays the new color setup that you have created. Note that you can also edit, copy, and delete color setups from the Color Setup Manager.

7. Click OK to confirm all the changes you have made in the Color Setup Manager and New Color Setup dialog boxes.

   The OK button saves the changes you have made and closes the Color Setup Manager. If you opened the Color Setup Manager from the Edit Page Setup dialog box, you can also save the changes by clicking the Select button. In addition to saving the changes, the Select button displays the selected color setup in the Edit Page Setup dialog box. The changes made to the color setup are still saved even if you cancel the changes to the page setup. To discard all changes, click Cancel in the Color Setup dialog box.

   You should however note that a color setup cannot be deleted from within the Page Setup dialog box. If you attempt this the following message appears:

```
Deleting a color setup from within the page setup dialog is not supported. Use Color
-> Color Setup Manager to complete task.
```

3.6 Customize page setups using new color setups

Having created your color setups, you are now ready to use them to customize page setups in the Harlequin RIP.

Note: You do not need to produce a color setup before you create a page setup. You can also open the Color Setup Manager from within the New Page Setup dialog box by clicking the Color Setup Manager icon.

When you open the Color Setup Manager in this way, the Harlequin RIP selects the device and color space of the current page setup. The procedure is otherwise as described in "Define color setups using ColorPro" on page 28.

1. Choose Harlequin RIP > Page Setup Manager.

2. In the Page Setup Manager dialog box, click **New**.
3. In the New Page Setup dialog box, select the appropriate **Device**.

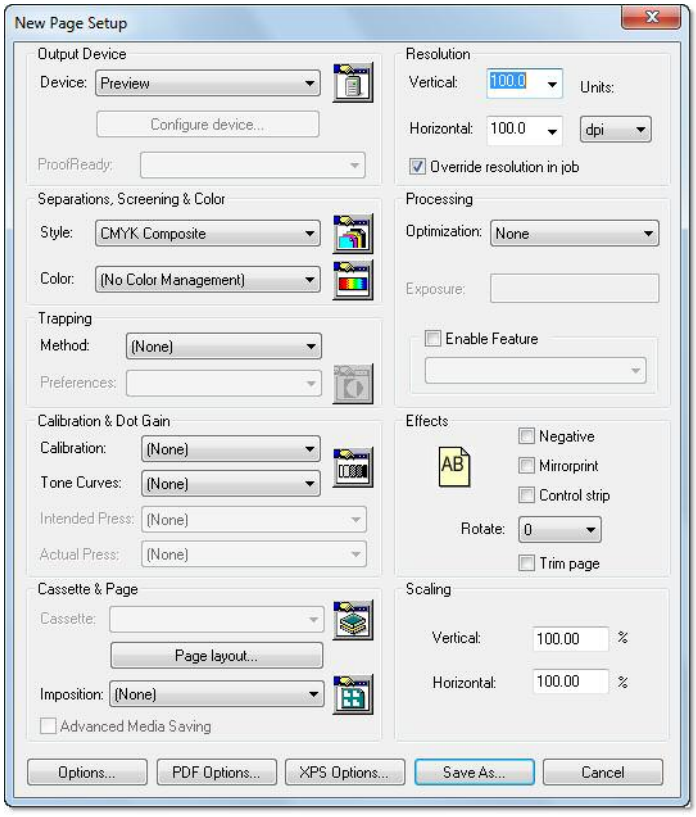

Figure 3.9 New Page Setup dialog box

4. If the button is enabled, click **Configure device** to specify settings for the output device you selected.
5. Under **Separations, Screening & Color**, select a separations style for this device from the **Style** menu. The choice of separations style determines the color space and format of the output. Click the **Separations Manager** button to create or edit a separations style. See "Configuring Output Formats" in the *Harlequin RIP OEM Manual* for further details.
6. Under **Separations, Screening & Color**, select the color setup you created from the **Color** menu. Alternatively, you can select any other color setup that was created for the currently selected device and color space. Click the **Color Setup Manager** button to create or edit a color setup.
7. You should now make sure your new color setup is selected in your Page Setup dialog.
8. Select a calibration set from the **Calibration** menu. See the recommendations for the specific device you are using.
9. Modify other options as needed. For a description of the other options see "Configuring Output Formats" in the *Harlequin RIP OEM Manual.*
10. When you are finished, click **Save As** to name and save this page setup. The Page Setup Manager dialog box displays the page setup you have created. Note that you can also copy, edit, or delete setups from the Page Setup Manager dialog box. Click **OK** to save all the changes you have made to page setups and to dismiss the Page Setup Manager dialog box.

3.7 Print using new page setup

You are now ready to print using your new page setup.

Printing a single file from the Harlequin RIP is useful for testing your page setup. Once you know that you have a good page setup, you can make it available to other users of the Harlequin RIP. For details on printing jobs from other computers on a network, see the "Configuring Input" chapter in the *Harlequin RIP OEM Manual*.

Follow these steps to print a single PostScript-language file.

1. Choose Harlequin RIP > Print File. The Print File dialog box appears.

Figure 3.10 Print File dialog box

2. Select the type of file you want to print from the Files of type menu.
3. Select a file or type a file name in the File Name field.
4. Select the page setup you defined from the Page Setup menu.
5. Click Print.

If this is the first time you are using newly defined color rendering intents to print a job, the Harlequin RIP requires a few extra minutes to produce the output. This is because the Harlequin RIP must generate the color rendering dictionaries before printing. If you submit another print job that uses the same intents, the Harlequin RIP does not regenerate these dictionaries and printing proceeds more quickly.

Appendix A – UCR and Black Generation

It is always desirable to use the full capabilities of an output device. This often means processing a supplied 3-color definition so that it uses all colors of a 4-color output device. There are various techniques for achieving this. *Undercolor removal* (UCR), *gray component replacement* (GCR), and *black generation* are some of these techniques.

Whether ColorPro color management is in use or not, you can see controls that apply these techniques in the Output Controls for RGB section of the Color Setup dialog box. This appendix describes the circumstance where each control has an effect.

A.1 The Harlequin RIP without ColorPro

In the Harlequin RIP without ColorPro enabled, UCR and black generation follow the settings in the Output Controls for RGB section of the Color Setup dialog box. You can select this from Color > Color Setup Manager > New 'No Color Management' Setup, or by clicking the Color Setup Manger icon from the tool bar or the Separations, Screening & Color section of the Edit Page Setup dialog.

It is worth stressing that this black generation affects only RGB color inputs, and only when RGB is expressed in a device-dependent way. CMYK and device-independent RGB are not affected by these settings.

See "Color Separation" in the *Harlequin RIP OEM Manual* for details.

A.2 The Harlequin RIP with ColorPro enabled

In the Harlequin RIP with ColorPro enabled and suitable profiles installed there are several possibilities:

- ColorPro and an ICC profile

  The black generation is defined in the output profile and cannot be altered.

- ColorPro and a device link profile

  The color transformation is specified in the device link profile and cannot be altered.

- ColorPro with the RGB input profile set to `(None)`

  In this case, UCR and black generation follow the settings in the Output controls for RGB section of the Color Setup dialog box. See the "Output Controls for RGB" on page 38 for details.

- ColorPro and a Harlequin profile

  The black generation is defined in the rendering intent. If you are using ColorPro, you can influence this by choosing values for Black generation and Maximum ink in the Color Rendering Intent Details dialog box. See page 27 for details.

When the ColorPro option is enabled, that option processes all device-independent color inputs. The information in the job is overridden by ColorPro if you select the Override color management in job check box in the Color Setup dialog box. If you leave this box unselected, Appendix C, "Jobs Containing Color Management Data" describes the rules used to decide how the data in the job takes effect.

Some common sources of device-independent RGB are calibrated color from applications such as Adobe PhotoShop, and PDF jobs.

Appendix B – Creating a Logo

ColorPro cannot guess when a graphic is a logo; it must be explicitly told.

To identify a logo, use the `setcolorrenderingintent` operator (a Harlequin extension to the PostScript language). For example, if an EPS file is to be treated as a logo, the line

```
/Logo setcolorrenderingintent
```

should appear at the start of the file.

The only way to insert this line is to edit the file by hand.

Appendix C – Jobs Containing Color Management Data

Settings within the Harlequin RIP, in the PostScript-language or PDF job, and in the images themselves can all control the processing of images in a job.

This appendix describes the settings that influence this processing and explains which setting takes precedence in each particular case. "Summary of options" on page 47 shows a summary in tabular form.

Note: Some options apply only to EPS files produced by Adobe Photoshop.

In addition, "Embedding ICC profiles in Photoshop images" on page 48 describes how to select the correct ICC profile for embedding in Photoshop 5.0 images and higher.

"PDF color management" on page 48 describes the cases specific to PDF jobs.

C.1 PostScript-language jobs and image files

The Harlequin RIP checks the following when processing jobs containing Photoshop EPS images or TIFF/JPEG images containing embedded ICC profiles:

- Does the current page setup use a color management option?
- Is the Override color management in job check box selected in the Color Setup dialog box?
- Does the image contain a PostScript color space array? (Photoshop EPS files only.)
- Does the image contain an embedded ICC profile?
- Is the `UseCIEColor` parameter set to `true` in the job?

C.2 Page setup uses a color management option

If the current page setup uses a ColorPro setup or No Color Management setup or both *and* the Override color management in job check box is selected in the Color Setup dialog box, the Harlequin RIP uses the settings in the Color setup. It treats the job as CMYK or RGB.

If the current page setup uses a Color Setup but the Override color management in job check box is not selected in the Color Setup dialog box, the Harlequin RIP checks for color management information in the image and the job. It uses the color management information in the following strict order:

- If the image contains a PostScript color space array (Photoshop EPS files only):

  The Harlequin RIP uses the color space array (CSA) to transform the image. It treats the image as a device-independent color image.

- Otherwise, if the image contains an embedded ICC profile:

  The Harlequin RIP uses the ICC profile to transform the image. It treats the image as a device-independent color image.

- Otherwise, if the `UseCIEColor` parameter set to `true` in the job:

  The Harlequin RIP uses the `DefaultGray`, `DefaultRGB` or `DefaultCMYK` color space resources to transform the image colors. It treats the image as a device-independent color image.

- Otherwise, if there is no color management information in the job:
  The Harlequin RIP uses the settings in the color setup. It treats the job as CMYK or RGB.

C.3 Summary of options

Override color management in job	Image contains a color space array	Image contains an embedded ICC profile	Job contains UseCIEColor set to	Result
Selected				Treat job as CMYK or RGB
Not selected	Yes			Use the CSA to transform the image
	No	Yes		Use the ICC profile to transform the image
		No	True	Use the DefaultGray, DefaultRGB or DefaultCMYK ColorSpace resources to transform image colors
			False or no value	Treat job as CMYK or RGB

Table C.1 Current page setup uses a color management option

Override color management in job	Image contains a color space array	Job contains UseCIEColor set to	Result
Selected		True	Use the DefaultGray, DefaultRGB or DefaultCMYK ColorSpace resources to transform image colors
		False or no value	Treat job as CMYK or RGB

Table C.2 Current page setup does not use a color management option

Override color management in job	Image contains a color space array	Job contains UseCIEColor set to	Result
Not selected	Yes		Use the CSA to transform the image
	No	True	Use the DefaultGray, DefaultRGB or DefaultCMYK ColorSpace resources to transform image colors
		False or no value	Treat job as CMYK or RGB

Table C.2 Current page setup does not use a color management option

C.4 Embedding ICC profiles in Photoshop images

This section describes how to select the correct ICC profile for embedding in Photoshop 5.0 images and higher. There are number of dialog boxes that relate to ICC profiles in Photoshop. Here we explain how to set the options in these Photoshop dialog boxes.

- File > Color Settings > Profile Setup

  In this dialog box you indicate which types of images should have profiles embedded (RGB, CMYK, Grayscale, and Lab). Also in this dialog box, you can select **Assumed Profiles**. Note that these assumed profiles are *not* the profiles that are embedded.

- File > Color Settings > RGB Setup
  File > Color Settings > Grayscale Setup

  These dialog boxes do not contain an explicit ICC Profile option. However, for RGB and Gray images, Photoshop converts the set of parameters selected in this dialog box to ICC profiles, and it is these profiles that are embedded. You can create ICC profiles directly using the **Save...** option in this dialog box.

  Note that "standard" ICC profiles are not supported in Photoshop 5.0 for RGB or grayscale images.

- File > Color Settings > CMYK Setup

  You select ICC profiles and also the Color Management Module using this dialog box. It is these profiles that are embedded.

C.5 PDF color management

PDF jobs can use a variety of color spaces, including device-dependent spaces such as `DeviceCMYK`.

Typically, when using device-independent color spaces, PDF version 1.2 files use the `CalGray` and `CalRGB` color spaces and PDF version 1.3 files use the `ICCBased` color space but these usages are under the control of the creating applications—see the Job Options dialog box: for the **Advanced** tab in Distiller 3.0; for the **Color** tab in Distiller 4.0.

Full use of device-independent color requires ColorPro to be enabled.

Appendix D – Overprinting options

Harlequin ColorPro provides various overprinting options and overrides in the Color Setup dialog box which when used together can become confusing. In an effort to help explain the effects of the various controls, a simple PostScript language file can be used.

D.1 Overprinting

This sample PostScript language file tests `setoverprint` and `setoverprintmode`.

```
%!PS
% Gray overprint tests
true setoverprint
true setoverprintmode
1 0 0 0 setcmykcolor
0 0 200 450 rectfill
0 0 0 0.5 setcmykcolor
25 25 150 75 rectfill      % BOTTOM BOX cmyk
0.5 setgray
25 150 150 75 rectfill     % MIDDLE BOX gray
.5 .5 .5 setrgbcolor
25 275 150 75 rectfill      % TOP BOX rgb
showpage
```

The table below shows the results when both `setoverprint` and `setoverprintmode` are set to `true`.

Override overprintmode in job	Overprint process colors	Overprint grays	Result
yes	yes	yes	CMYK and gray overprint, RGB knockout
yes	yes	no	CMYK overprint, gray and RGB knockout
yes	no	no	All knockout
no	yes	yes	CMYK and gray overprint, RGB knockout
no	yes	no	CMYK overprint, gray and RGB knockout
no	no	yes	CMYK and gray overprint, RGB knockout
no	no	no	CMYK overprint, gray and RGB knockout

Table D.1 `setoverprint=true` and `setoverprintmode=true`

In the following table, with the sample PostScript language file, `setoverprintmode` is `false`.

Override overprintmode in job	Overprint process colors	Overprint grays	Result
yes	yes	yes	CMYK and gray overprint, RGB knockout
yes	yes	no	CMYK overprints, gray and RGB knockout
yes	no	no	All knockout
no	yes	yes	All knockout
no	yes	no	All knockout
no	no	yes	All knockout
no	no	no	All knockout

Table D.2 `setoverprint=true` and `setoverprintmode=false`

The table below shows the results when both `setoverprint` and `setoverprintmode` are set to `false`.

Override overprintmode in job	Overprint process colors	Overprint grays	Result
yes	yes	yes	All knockout
yes	yes	no	All knockout
yes	no	no	All knockout
no	yes	yes	All knockout
no	yes	no	All knockout
no	no	yes	All knockout

Table D.3 `setoverprint=false` and `setoverprintmode=false`

Override overprintmode in job	Overprint process colors	Overprint grays	Result
no	no	no	All knockout

Table D.3 `setoverprint=false` and `setoverprintmode=false`

D.2 Drop white objects

This sample PostScript Language file tests the Drop white objects option:

```
%!PS
% Drop white objects test
true setoverprint
  true setoverprintmode
  0 1 0 0 setcmykcolor 0 0 72 72 rectfill
  0 0 0 0 setcmykcolor 0 0 60 60 rectfill
  showpage
%%EOF
```

The table below shows the results when both `setoverprint` and `setoverprintmode` are set `true`.

Override overprintmode in job	Overprint process colors	Drop white objects	Result
yes	yes	yes	Box
yes	yes	no	Border
yes	no	no	Border
no	yes	yes	Box
no	yes	no	Border
no	no	yes	Box
no	no	no	Border

Table D.4 `setoverprint=true` and `setoverprintmode=true`

The table below shows the results when `setoverprint` is `true` and `setoverprintmode` set to `false`.

Override overprintmode in job	Overprint process colors	Drop white objects	Result
yes	yes	yes	Box
yes	yes	no	Border
yes	no	no	Border
no	yes	yes	Border
no	yes	no	Border
no	no	yes	Border
no	no	no	Border

Table D.5 `setoverprint=true` and `setoverprintmode=false`

When both `setoverprint` and `setoverprintmode` are set `false`, all results are "Border".

Appendix E – Supplied Profiles

Global Graphics supplies the following profiles with the Harlequin RIP. The systems represented have a significant variation in color characteristics, so you should consider these profiles as being representative of the systems rather than being an exact match to any single system.

These profiles are listed alphabetically in separate sections for:

- CMYK input profiles. See "CMYK Input Profiles", on page 52.
- RGB input profiles. See "RGB Input Profiles", on page 53.
- CMYK output profiles. See "CMYK Output Profiles (for Printing Press)", on page 54.

E.1 CMYK Input Profiles

Agfa Pressmatch (Commercial)
Profile to simulate the film based Agfa Pressmatch proofing system using Agfa's commercial stock proofing substrate.

Agfa Pressmatch Commercial color space
Profile of a proofing system designed to match Euro standard printing inks on a commercial base. This matches a standard dot gain (22-17%) printing process. Tone value rendition of 2-98%.

3M Matchprint
Profile of a proofing system designed to match European printing inks using a publication base. This matches a low-gain (12%-14%) printing process.

3M Matchprint (Standard)
Profile of a proofing system designed to match European printing inks using a publication base. This matches a *standard* gain (24%) printing process.

BVD-FOGRA positive gloss
Profile of a European commercial/speciality and heat-set web offset printing press conforming to ISO 12647 as specified by BVD/FOGRA. This specification is 60 lines per centimeter (lpcm), positive plates, gloss-coated, wood-free, 115 grams per square meter (gsm).

BVD-FOGRA positive LWC
Profile of a European commercial/speciality and heat-set web offset printing press conforming to ISO 12647 as specified by BVD/FOGRA. (60 lpcm, positive plates, gloss-coated web, 70 gsm).

BVD-FOGRA positive matt
Profile of a European commercial/speciality and heat-set web offset printing press conforming to ISO 12647 as specified by BVD/FOGRA. (60 lpcm, positive plates, matt-coated, wood-free, 115 gsm).

BVD-FOGRA positive uncoated
Profile of a European commercial/speciality and heat-set web offset printing press conforming to ISO 12647 as specified by BVD/FOGRA. (60 lpcm, positive plates, uncoated white paper, 120 gsm).

Commercial A
Profile of a Heidelberg MO printing press using standard European printing inks and a coated commercial paper stock.

DuPont Cromalin
Profile of a proofing system designed to match a typical European *low* gain commercial printing press.

DuPont Cromalin (ES-96)
Profile of a proofing system designed to match a typical European *standard* gain commercial printing press.

DuPont WaterProof Commercial
Profile of a proofing system designed to match a typical US printing press with between 17% and 20% dot gain on 'Commercial' paper base.

DuPont WaterProof Publication
Profile of a proofing system designed to match a typical US printing press with between 17% and 20% dot gain on 'Publication' paper base.

Fuji ColorArt Commercial CR-T3 Gloss
Profile of a proofing system designed to match typical US printing [Commercial CR-T3 Gloss base].

Fuji ColorArt Publication CR-T3 MMatte
Profile of a proofing system designed to match typical US printing [Publication CR-T3 Medium Matte base].

SWOP (CGATS TR001)
Profile of a printing press configured by CGATS to meet the specifications for SWOP printing.

E.2 RGB Input Profiles

sRGB Profile of a color space proposed by Hewlett Packard and Microsoft which is designed to be used as a basis for color management of World Wide Web images.

Office Graphics RGB
This profile is based on cool white flourescent tubes at a brightness level found in a typical office.

Trinitron Profile of a monitor using Trinitron phosphors and set up in a *standard* way.

E.3 CMYK Output Profiles (for Printing Press)

BVD-FOGRA positive gloss

Profile of a European commercial/speciality and heat-set web offset printing press conforming to ISO 12647 as specified by BVD/FOGRA. (60 lpcm, positive plates, gloss-coated, wood-free, 115 gsm).

BVD-FOGRA positive LWC

Profile of a European commercial/speciality and heat-set web offset printing press conforming to ISO 12647 as specified by BVD/FOGRA. (60 lpcm, positive plates, gloss-coated web, 70 gsm).

BVD-FOGRA positive matt

Profile of a European commercial/speciality and heat-set web offset printing press conforming to ISO 12647 as specified by BVD/FOGRA. (60 lpcm, positive plates, matt-coated, wood-free, 115 gsm).

BVD-FOGRA positive uncoated

Profile of a European commercial/speciality and heat-set web offset printing press conforming to ISO 12647 as specified by BVD/FOGRA. (60 lpcm, positive plates, uncoated white paper, 120 gsm).

Commercial A

Profile of a Heidelberg MO printing press using standard European printing inks and a coated commercial paper stock.

SWOP (CGATS TR001)

Profile of a printing press configured by CGATS to meet the specifications for SWOP printing.

Appendix F – Seeing Color

This appendix gives a brief description of the perception and measurement of color. It forms an introduction to understanding the issues in color printing, listed in Appendix G, "Printing Color".

F.1 Perception of color

The perception of color is both biological and psychological. The biological aspect is the eye's detection of certain wavelengths of light. The psychological aspect is the way the sensation of color is processed by the mind. For hundreds of years, researchers have tried to express the human perception of color in objective and quantifiable terms. But since all people vary in how they process color, this has been a formidable task.

From a purely physical point of view, seeing color requires the presence of three elements: a light source, an object that interacts with the light, and a receiver (the eye). An object has a "color" because it absorbs some wavelengths and reflects or transmits others. For example, a tomato appears red because it absorbs green and blue light and reflects red light.

Light, a form of electromagnetic energy, can be described as waves. The length of a wave is its wavelength. Wavelengths are measured in nanometers (nm), that is, one millionth of a millimeter. Wavelengths between 400 and 700 nm are visible to the human eye. "Red," "Green," and other colors are names assigned to a certain range of wavelength.

F.2 Additional reading

Billmeyer Jr., Fred W. and Max Saltzman. *Principles of Color Technology, 2nd edition*. John Wiley and Sons, 1981

Hunt, R.W.G. *The Reproduction of Color in Photography, Printing, and Television, 4th edition*. Fountain Press, 1987

Hunt, R.W.G. *Measuring Color, 2nd edition*. Ellis Horwood, 1992

Judd, D.B. and Wyszecki, Gunter. *Color in Business, Science and Industry, 3rd edition*. John Wiley and Sons, 1975

X-Rite Inc. *Understanding Color Communication*

X-Rite Inc. *Understanding Graphic Arts Densitometry*

Appendix G – Printing Color

This appendix describes the issues in achieving faithful color reproduction and how the treatment of these issues has changed with the availability of digital technology and device-independent color.

G.1 Issues in color printing

Color printing is a difficult art. At the core is the following problem: how does one person (or scanner, application, and so on) specify a color sufficiently for another person (or printer, monitor, and so on) to reproduce the color as the first person intended.

The color printing process begins with the designer's ideas and the customer's specifications. These specifications must be communicated to many people who will render and reproduce these colors on different devices. At each stage of production, output from one process becomes input for the next process. Each of these processes involves color in a different color space; from photographic film to monitor RGB to CMYK printing on different output devices. At each step, judgement on color is made by different viewers under different viewing conditions.

With the proliferation of affordable and quality input/output devices and software packages, users are no longer buying solutions from a single vendor. Rather, they purchase different system components from different vendors and combine the elements to create an integrated process. This creates an increasing need for effective color management.

G.2 Color management

The task of color management is to ensure that color jobs from many different sources and printed on many different devices appear consistent. Color management allows a printer to manipulate any type of color image using any type of device to reliably render the output on any type of media in a seamless manner.

In a traditional setup, a printer who was asked to reproduce a colored picture would scan the picture and use the resulting data to make films and plates for use on a particular press. Since the press was run in a controlled, consistent way, and the scanner was set up to produce good output on a particular press, this method would reliably produce color output.

This method, however, has its limitations. A very important limitation is that it does not provide an easy way to ensure consistent color reproduction across different printing environments. In the traditional setup, the printing job is not portable to another device or another printing environment. In addition, since prints are manually defined and manipulated with density readings, formal training and education is required for proper handling of print jobs.

The biggest advantage in many of today's color management solution systems is their ability to transform color into device-independent color and thereby make the job available for print on any device. For instance, a file that has been proofed on a inkjet printer can be separated, accurately output on a film imagesetter, and passed to a color printing press for printing with good agreement between the initial proof and the final production print run.

G.3 Color gamuts

The color gamut is the entire range of colors possible in a color system such as a photograph, a color monitor, or a printing process. The larger the color gamut, the larger the number of distinct colors (shades) the eye perceives. The human eye is capable of perceiving billions of different colors. In contrast, a color monitor has an upper limit of sixteen million colors that it can reproduce, and a printing press might typically manage five thousand.

In the CIE *x-y* chromaticity diagram, shown in Figure G.1, the pure spectral colors are distributed around the curved edge of a horseshoe-shaped chart, with a straight line connecting the blue and red ends of that curve. The strongest (purest) colors are at the edge of the diagram, while mixtures of those colors fill the interior. (All the color names are informal indications of which color appears where; a label like **Red** is too imprecise for scientific or technical use, unless it is given an accompanying specification.) The interior colors vary smoothly with position, with the influence of the colors on the edge diminishing as the distance from the edge increases. The small black square near the center of the horseshoe shape indicates white or the absence of a color bias.

For example, a straight line passing from the edge at the point labeled **Red** to the square representing **White** would pass from a saturated red, through areas with lightening shades of pink, before arriving at white. Similarly, a line staying near the edge and passing from **Red** to **Yellow** would pass through areas of red, orange, and yellow.

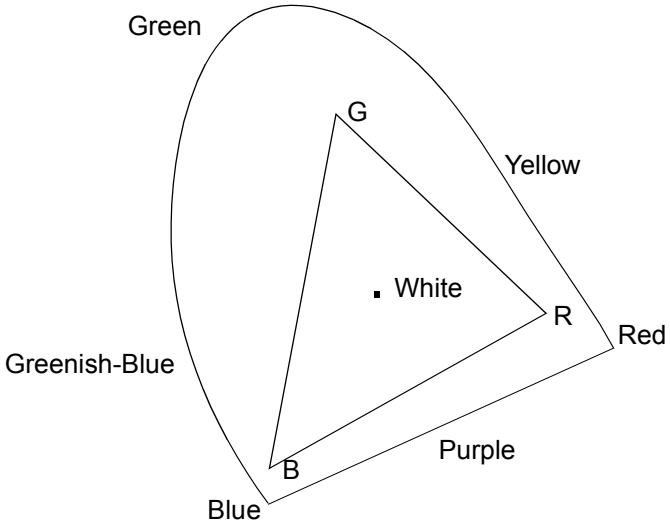

Figure G.1 CIE 1931 chromaticity diagram

Figure G.1 also shows the typical gamut of a color monitor. The difficulties of using informal color names become obvious when you know that the corners of this triangular gamut, **RGB**, are often called Red, Green, and Blue.

Figure G.2 shows that different devices have different color gamuts; colors that can be created on one device can be beyond the capabilities of other devices. Gamuts are influenced by calibration, environment, age of the device, model of the device, and so on.

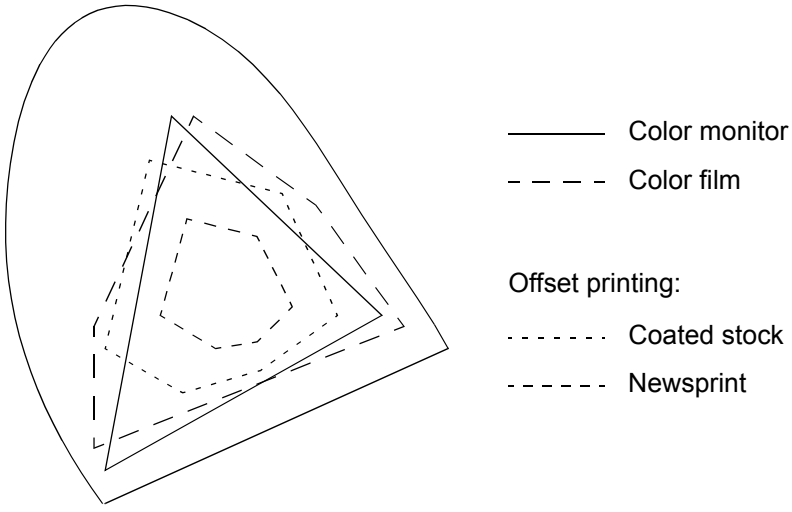

Figure G.2 Color gamuts available

For a given process, many colors simply cannot be reproduced. Furthermore, different processes can reproduce different colors: given two offset printers, for example, each can probably image some colors that the other is not capable of imaging.

G.4 Device-independent and device-dependent color

A device-dependent color scheme specifies how to reproduce a color on a particular device, by saying how much of each colorant to use. The limitation of using this scheme is that the appearance of the final output may vary depending on the kinds of CMYK inks used, the color the paper is printed on, the viewing conditions, and so on. (There are similar variations for RGB systems, depending on the display phosphors, monitor settings and so on.) The result is that it is not possible to predict the exact appearance of device-dependent color jobs until they are printed.

One workaround to using the device-dependent color scheme is to adapt the job for a particular printer. The original CMYK data is adjusted according to the known characteristics of the output device, and then printed. This scheme works quite well where a job is always printed on the same printer and setup, but if printed on a different printer with a different setup, the job will almost certainly look different. A CMYK job will only use the colors in the gamut of a "typical" CMYK printer. If the final medium has a bigger color range, colors are needlessly restricted.

A device-independent color scheme is specified in a general way, independent of the final output device. The work of the International Committee of Illumination (CIE) over the past 50 years has established a number of standards for doing this. One important issue when using the device-independent scheme is that a job may specify colors that are not within the gamut of the printer. Mapping unprintable colors to printable colors becomes an important science when using device-independent color schemes.

Device profiles — software that translates color data for one device between its native color space and a standard color space (the ICC profile connection space) — assist in this mapping. A device profile is a table or mathematical expression that characterizes the color behavior of a color imaging device. Profiles can be used for scanners or input devices, for monitors, and for printers and other output devices. The ICC (International Color Consortium) has standardized templates for these profiles. These profiles are supplied by the device manufacturer, generated by the user, or sold as part of a color management system. By obtaining a compatible color-management system and one device profile for each piece of equipment, you can make that equipment part of the system.

Note: ICC-compatible profiles that characterize the same device do not necessarily provide and guarantee the same quality.

Device link profiles, despite the similar name, have a different and more limited function. A device link profile translates color data for the native color space of one device to and from the native color space of one other device. Each pair of devices requires a separate device link profile. For three devices, there are three pairs; for four devices, there are six pairs; and the number of pairs rises rapidly. Device link profiles can provide high quality translations, but do not allow for intermediate color management.

G.5 Mapping between gamuts

When the input and output gamuts of a system differ, only the colors within both gamuts can be reproduced exactly. Figure G.3 shows the gamut of a monitor (input) and printer (output) in an area where there are other colors, some possible only on the monitor and some possible only on the printer. Some mapping is necessary to reproduce colors possible only on the monitor on the output printer.

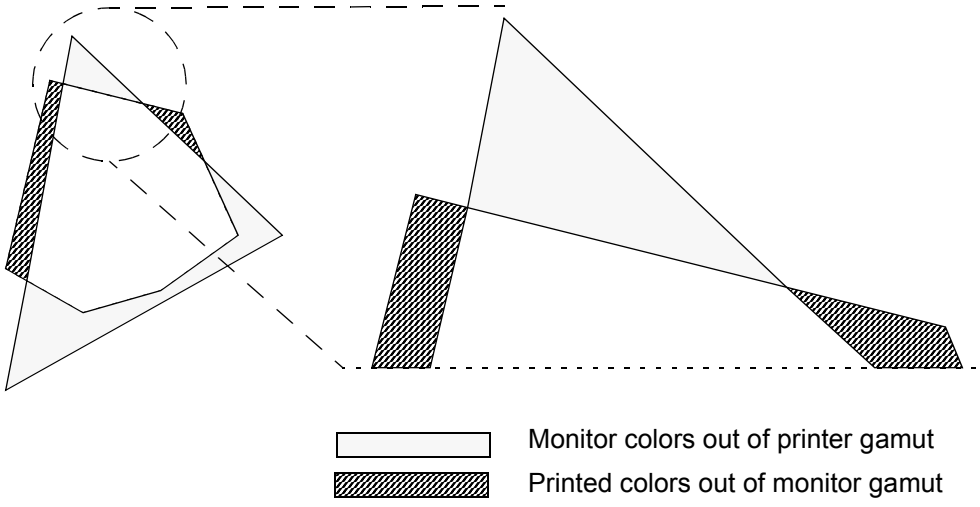

Figure G.3 Detail of out of gamut areas

There are several possible mappings. To show how some of these mappings work, we can consider example colors possible on the monitor but not possible on the printer.

In Figure F.4, colors out of the printer gamut are mapped to a 'nearby' point on the edge of the gamut. In this example, A1 is already at a point on the printer gamut limit, and points A2 and A3 are outside the gamut limit. A1 (and all colors within the printer gamut) are reproduced exactly. Points A2 and A3 are mapped to the 'nearby' points on the printer gamut, B2 and B3 respectively. This is absolute colorimetric mapping.

Note: In the following diagrams, the direction of the arrows for mapped colors points towards a white point.

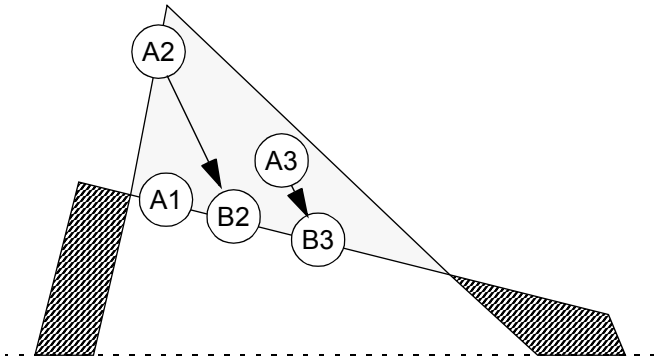

Figure G.4 Absolute colorimetric mapping

Figure G.5 shows perceptual mapping, a scheme in which there are no abrupt changes in mapping. Colors at the edge of the input gamut (A2) map to the edge of the output gamut (C2). Other out of gamut colors map to colors just inside the output gamut map. Even colors within the printer gamut are mapped, to a degree that depends on their distance from the edge of the printer gamut.

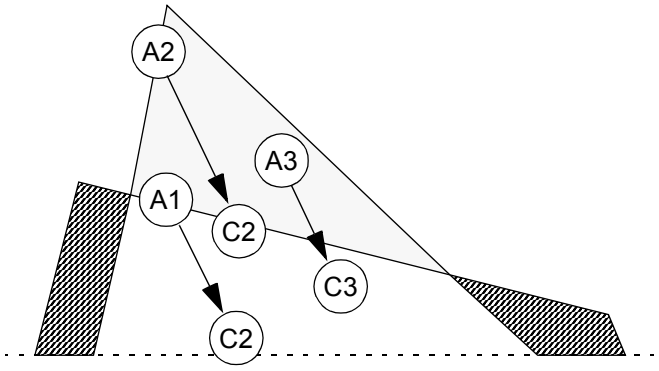

Figure G.5 Perceptual mapping

There are other possible mappings, but these are harder to show in the chromaticity diagram.

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